

# DEPARTMENT OF COMMERCE.

BUREAU OF STANDARDS.

GEORGE K. BURGESS, Director.

## 1924 (JANUARY) SUPPLEMENT TO CIRCULAR NO. 24: PUBLICATIONS OF THE BUREAU OF STANDARDS.

This supplement is issued from time to time to keep current and to supplement the information given in Circular of the Bureau of Standards, No. 24: Publications of the Bureau of Standards. This supplement will bring up to date the information listed below under "Contents."

### CONTENTS.

	Page.
1. Designations of publication series.....	1
2. Publications not available.....	1
3. Distribution .....	2
4. Bound volumes .....	2
5. Price list of bound volumes .....	2
6. Latest data concerning current editions of circulars .....	3
7. Government depository reference libraries.....	4
8. Announcements of new publications .....	8
9. Subject index to new publications .....	41

### 1. DESIGNATIONS OF PUBLICATION SERIES.

Six series are issued: Scientific Papers, Technologic Papers, Circulars, Handbooks, Simplified Practice Recommendations, and Miscellaneous Publications. The separate papers in each series are consecutively numbered. An initial letter preceding each number shows the particular series: S for Scientific Papers, T for Technologic Papers, C for Circulars, H for Handbooks, M for Miscellaneous Publications, R for Simplified Practice Recommendations—thus T<sub>203</sub> is "Technologic Papers, No. 203." In referring to publications the series *initial* and the *number* are *both* needed to give complete identification.

### 2. PUBLICATIONS NOT AVAILABLE.

The publications listed below are not available for distribution by the Bureau of Standards nor for sale by the Superintendent of Documents. They may be consulted at some of the designated Government depository libraries listed on page 4.

*Scientific Papers.*—S<sub>1</sub>, S<sub>2</sub>, S<sub>3</sub>, S<sub>4</sub>, S<sub>12</sub>, S<sub>13</sub>, S<sub>16</sub>, S<sub>19</sub>, S<sub>22</sub>, S<sub>24</sub>, S<sub>25</sub>, S<sub>27</sub>, S<sub>29</sub>, S<sub>33</sub>, S<sub>34</sub>, S<sub>35</sub>, S<sub>36</sub>, S<sub>37</sub>, S<sub>38</sub>, S<sub>39</sub>, S<sub>41</sub>, S<sub>42</sub>, S<sub>43</sub>, S<sub>44</sub>, S<sub>45</sub>, S<sub>46</sub>, S<sub>49</sub>, S<sub>50</sub>, S<sub>51</sub>, S<sub>52</sub>, S<sub>55</sub>, S<sub>58</sub>, S<sub>59</sub>, S<sub>60</sub>, S<sub>61</sub>, S<sub>62</sub>, S<sub>68</sub>, S<sub>72</sub>, S<sub>77</sub>, S<sub>79</sub>, S<sub>81</sub>, S<sub>84</sub>, S<sub>89</sub>, S<sub>90</sub>, S<sub>93</sub>, S<sub>94</sub>, S<sub>95</sub>, S<sub>96</sub>, S<sub>100</sub>, S<sub>102</sub>, S<sub>103</sub>, S<sub>104</sub>, S<sub>105</sub>, S<sub>108</sub>, S<sub>112</sub>, S<sub>113</sub>, S<sub>114</sub>, S<sub>115</sub>, S<sub>118</sub>, S<sub>121</sub>, S<sub>122</sub>, S<sub>123</sub>, S<sub>125</sub>, S<sub>128</sub>, S<sub>129</sub>, S<sub>130</sub>, S<sub>133</sub>, S<sub>138</sub>, S<sub>139</sub>, S<sub>140</sub>, S<sub>142</sub>, S<sub>143</sub>, S<sub>146</sub>, S<sub>147</sub>, S<sub>149</sub>, S<sub>151</sub>, S<sub>155</sub>, S<sub>157</sub>, S<sub>162</sub>, S<sub>165</sub>, S<sub>166</sub>, S<sub>168</sub>, S<sub>173</sub>, S<sub>174</sub>, S<sub>182</sub>, S<sub>187</sub>, S<sub>189</sub>, S<sub>190</sub>, S<sub>202</sub>, S<sub>203</sub>, S<sub>212</sub>, S<sub>213</sub>, S<sub>214</sub>, S<sub>215</sub>, S<sub>216</sub>, S<sub>226</sub>, S<sub>228</sub>, S<sub>232</sub>, S<sub>233</sub>, S<sub>241</sub>, S<sub>243</sub>, S<sub>255</sub>, S<sub>258</sub>, S<sub>261</sub>, S<sub>269</sub>, S<sub>275</sub>, S<sub>279</sub>, S<sub>285</sub>, S<sub>291</sub>, S<sub>381</sub>, S<sub>422</sub>.

*Technologic Papers.*—T<sub>2</sub>, T<sub>3</sub>, T<sub>5</sub>, T<sub>14</sub>, T<sub>17</sub>, T<sub>19</sub>, T<sub>23</sub>, T<sub>26</sub>, T<sub>27</sub>, T<sub>28</sub>, T<sub>30</sub>, T<sub>31</sub>, T<sub>32</sub>, T<sub>35</sub>, T<sub>37</sub>, T<sub>39</sub>, T<sub>44</sub>, T<sub>45</sub>, T<sub>46</sub>, T<sub>48</sub>, T<sub>51</sub>, T<sub>54</sub>, T<sub>57</sub>, T<sub>65</sub>, T<sub>68</sub>, T<sub>71</sub>, T<sub>73</sub>, T<sub>74</sub>, T<sub>78</sub>, T<sub>82</sub>, T<sub>100</sub>, T<sub>108</sub>, T<sub>118</sub>, T<sub>122</sub>, T<sub>137</sub>.

*Circulars.*—C<sub>1</sub>, C<sub>2</sub>, C<sub>4</sub>, C<sub>8</sub>, C<sub>12</sub>, C<sub>14</sub>, C<sub>15</sub>, C<sub>21</sub>, C<sub>22</sub>, C<sub>23</sub>, C<sub>28</sub>, C<sub>29</sub>, C<sub>34</sub>, C<sub>39</sub>, C<sub>45</sub>, C<sub>50</sub>, C<sub>54</sub>.

*Miscellaneous Publications.*—M<sub>1</sub>, M<sub>4</sub>, M<sub>5</sub>, M<sub>8</sub>, M<sub>11</sub>, M<sub>13</sub>, M<sub>17</sub>, M<sub>18</sub>, M<sub>20</sub>, M<sub>22</sub>, M<sub>25</sub>, M<sub>29</sub>, M<sub>30</sub>, M<sub>31</sub>, M<sub>33</sub>, M<sub>34</sub>, M<sub>35</sub>, M<sub>36</sub>, M<sub>38</sub>, M<sub>50</sub>.

### 3. DISTRIBUTION.

A small edition is available for official distribution to libraries, technical journals, and experts who cooperate in the work or who are directly concerned with it. Others may purchase the publications at the nominal price shown. The large number of requests for Bureau of Standard publications precludes sending personally dictated replies in each case. Each request, however, is given careful attention and a typed form letter reply is prepared, stating fully the action taken on each item of the request or other information needed.

### 4. BOUND VOLUMES.

The separate Scientific Papers (the original term "Reprints" is not now used) are consecutively paged to about 750 pages, which make up a complete volume. Title-page and index are then printed and the completed volume is bound.

### 5. PRICE LIST FOR BOUND VOLUMES.

	Per volume.
(a) Bulletins of the Bureau of Standards, vols. 1-14, inclusive; 1904-1914 (cloth).....	\$2.00
(b) Series (a) continued—Scientific Papers of the Bureau of Standards, vols. 15-18 (cloth).....	2.00
(c) Unbound separates, preprints of (b), sent as issued.....	1.25
(d) Combination of (c) and (b).....	3.25
(e) Technologic Papers of the Bureau of Standards, vol. 16 (cloth).....	2.00
(f) Unbound separates of Technologic Papers sent as issued.....	1.25
(g) Combination of (f) and (e).....	3.25

Subscriptions for either series may be placed in advance with the Superintendent of Documents to receive the separates as issued at \$1.25 per volume (unbound), and \$2 for each volume bound in cloth.

Purchase orders with remittance should be sent addressed simply Superintendent of Documents, Government Printing Office, Washington, D. C. Do not send any such orders or remittances elsewhere. Order by serial initial letter and number combined (for example, T<sub>203</sub>). If initial and number are correctly given, the title is not needed. All publications are sent out by the Superintendent of Documents, as provided by law, and usually reach destination within a week or two.

## 6. LATEST DATA CONCERNING CURRENT EDITIONS OF CIRCULARS.

Cir. No.	Edi-tion.	Date.	No. of pages.	Price.	Cir. No.	Edi-tion.	Date.	No. of pages.	Price.
1.....	1	Dec. 1, 1903	3	.....	75.....	1	Jan. 10, 1918	127	15
2.....	5	Apr. 30, 1915	21	5	76.....	1	Apr. 21, 1919	120	20
3.....	3	Dec. 23, 1918	89	15	77.....	1	Mar. 10, 1919	67	10
4.....	2	Jan. 3, 1905	2	.....	78.....	2	Mar. 20, 1923	14	5
5.....	3	July 16, 1917	19	5	79.....	2	Jan. 19, 1923	53	15
6.....	7	Dec. 30, 1916	30	5	80.....	2	Sept. 2, 1922	34	20
7.....	5	Oct. 1, 1913	19	5	81.....	2	Dec. 21, 1922	32	10
8.....	3	Aug. 11, 1921	18	5	82.....	2	June 8, 1922	9	5
9.....	8	Mar. 31, 1916	32	10	83.....	1	Jan. 31, 1920	35	5
10.....	3	May 9, 1918	19	5	84.....	2	July 3, 1922	8	5
11.....	3	June 23, 1917	18	5	85.....	2	July 3, 1922	9	5
12 <sup>1</sup> .....	1	July 16, 1906	7	.....	86.....	2	Oct. 6, 1922	11	5
13.....	10	Feb. 7, 1923	17	5	87.....	2	July 3, 1922	8	5
14.....	5	Mar. 20, 1916	17	10	88.....	2	July 3, 1922	8	5
15.....	3	July 1, 1911	7	5	89.....	2	July 3, 1922	10	5
16.....	5	July 13, 1922	16	5	90.....	2	May 23, 1922	8	5
17.....	3	Mar. 18, 1916	50	15	91.....	2	June 21, 1922	8	5
18.....	2	July 1, 1911	4	5	92.....	1	June 7, 1920	94	30
19.....	5	Mar. 30, 1916	67	15	93.....	2	June 21, 1922	9	5
20.....	2	May 28, 1915	57	15	94.....	2	July 7, 1922	8	5
21.....	1	Mar. 1, 1910	30	5	95.....	1	June 28, 1920	24	5
22.....	2	May 15, 1911	12	.....	96.....	1	June 15, 1920	5	5
23.....	1	July 15, 1910	93	15	97.....	3	July 3, 1922	10	5
24.....	6	July 1, 1922	182	.....	98.....	2	Feb. 29, 1923	10	5
25.....	8	June 26, 1923	14	5	99.....	1	Nov. 12, 1920	44	10
26.....	4	Apr. 5, 1921	20	5	100.....	1	Mar. 21, 1921	106	20
27.....	2	Aug. 9, 1918	41	10	101.....	1	Feb. 9, 1921	52	10
28.....	1	Mar. 1, 1911	19	.....	102.....	2	Sept. 22, 1922	5	5
29.....	1	Dec. 31, 1910	13	.....	103.....	3	July 22, 1922	6	5
30.....	2	July 6, 1920	25	5	104.....	2	Jan. 31, 1923	7	5
31.....	3	Oct. 1, 1914	76	20	105.....	2	Sept. 18, 1922	4	5
32.....	4	Dec. 7, 1920	140	20	106.....	1	Nov. 24, 1920	15	5
33.....	3	Jan. 18, 1917	43	10	107.....	1	Feb. 12, 1921	37	10
34.....	3	May 15, 1915	16	5	108.....	1	Jan. 3, 1921	21	5
35.....	4	Dec. 1, 1919	2	5	109.....	1	Jan. 3, 1921	9	5
36.....	1	June 30, 1912	26	5	110.....	1	Feb. 26, 1921	8	5
37.....	2	Jan. 1, 1915	13	5	111.....	2	June 24, 1922	8	5
38.....	4	Sept. 28, 1921	127	20	112.....	1	June 24, 1921	214	65
39.....	1	Dec. 15, 1912	14	5	113.....	2	July 7, 1922	104	25
40.....	3	Sept. 10, 1920	13	5	114.....	1	July 30, 1921	10	5
41.....	3	Sept. 20, 1918	15	5	115.....	1	Oct. 27, 1921	18	5
42.....	2	Aug. 29, 1921	11	5	116.....	1	Aug. 17, 1921	5	5
43.....	2	Jan. 24, 1921	46	10	117.....	2	July 3, 1922	6	5
44.....	2	Jan. 30, 1918	196	25	118.....	1	Dec. 8, 1921	7	5
45.....	1	Nov. 1, 1913	89	10	119.....	1	Feb. 6, 1922	3	5
46.....	3	Dec. 26, 1922	22	10	120.....	1	Apr. 24, 1922	16	5
47.....	1	July 1, 1914	68	15	121.....	1	July 17, 1922	14	5
48.....	2	June 10, 1916	202	40	122.....	2	Sept. 12, 1923	16	5
49.....	2	May 4, 1915	50	10	123.....	1	July 27, 1922	5	5
50.....	2	June 8, 1917	34	5	124.....	1	July 27, 1922	4	5
51.....	1	Dec. 1, 1914	39	15	125.....	1	July 27, 1922	3	5
52.....	2	June 28, 1916	44	10	126.....	1	July 27, 1922	5	5
53.....	1	Mar. 29, 1915	35	10	127.....	1	July 27, 1922	4	5
54 <sup>2</sup> .....	2	Nov. 15, 1916	323	30	128.....	1	July 27, 1922	5	5
55.....	1	Aug. 28, 1915	149	15	129.....	1	July 27, 1922	4	5
56.....	2	Sept. 26, 1923	262	60 <sup>25</sup>	130.....	1	July 27, 1922	5	5
57.....	2	May 11, 1916	64	15	131.....	1	July 27, 1922	5	5
58.....	2	June 22, 1923	68	10	132.....	1	July 27, 1922	4	5
59.....	1	Apr. 5, 1916	13	5	133.....	1	Nov. 10, 1922	21	10
60.....	2	Mar. 12, 1920	68	15	134.....	1	Sept. 16, 1922	4	5
61.....	2	Aug. 31, 1920	44	10	135.....	1	Oct. 16, 1922	14	5
62.....	3	Jan. 24, 1923	24	5	136.....	1	Sept. 22, 1922	4	5
63.....	1	May 17, 1917	8	5	137.....	1	Feb. 23, 1923	19	10
64.....	1	Apr. 20, 1917	6	5	138.....	1	Mar. 21, 1923	33	10
65.....	1	July 23, 1917	19	5	139.....	1	June 15, 1923	9	5
66.....	1	July 25, 1917	13	5	140.....	1	Mar. 26, 1923	6	5
67.....	1	Jan. 17, 1918	8	5	141.....	1	Mar. 24, 1923	18	10
68.....	1	Oct. 6, 1917	8	5	142.....	1	Apr. 16, 1923	48	15
69.....	1	Nov. 17, 1917	85	15	143.....	1	June 25, 1923	5	5
70.....	1	Dec. 5, 1917	259	25	144.....	1	July 6, 1923	7	5
71.....	1	Sept. 18, 1917	8	5	145.....	1	.....	.....	.....
72.....	1	June 17, 1918	84	20	146.....	1	Sept. 25, 1923	6	5
73.....	2	Nov. 14, 1922	113	20	147.....	1	Sept. 19, 1923	8	5
74.....	1	Mar. 23, 1918	330	60	148.....	1	Oct. 10, 1923	9	5

1 Superseded by C44.

2 Superseded by H3 and H4.

## 7. GOVERNMENT DEPOSITORY REFERENCE LIBRARIES.

Congress designates in the several congressional districts certain libraries as "Government depository libraries." These receive sets of Government publications on the understanding that they are kept available for consultation by the general public.

If a publication is requested which can not be obtained free from the bureau or by purchase from the Superintendent of Documents, the bureau refers the correspondent to the nearest depository reference library where the bureau's publications may be consulted.

State or Territory.	City.	Name of library.	State or Territory.	City.	Name of library.
Ala. ....	Athens.....	Athens College.	Del. ....	Dover.....	Delaware State.
	Auburn.....	Alabama Polytechnic Institute.		Newark.....	Delaware College.
	Birmingham.....	Howard College.		Newcastle.....	Newcastle Library Co.
	Mobile.....	Public.		Wilmington.....	Free.
	Montgomery.....	Association Public.	D. C. ....	Washington.....	Agricultural Department.
	Tuskegee Institute.....	State Capitol.			Army War College.
Alaska .	University.....	State and Supreme Court.			Interior Department.
	Fairbanks.....	Carnegie.			Justice Department.
	Juneau.....	University of Alabama.	Fla. ....	DeLand.....	Navy Department.
Ariz....	Phoenix.....	St. Matthews Free Public.		Gainesville.....	State Department.
	Tucson.....	Alaska Historical Society and Museum.		Jacksonville.....	Treasury Department.
	Conway.....	Arizona State.		Tallahassee.....	John B. Stetson University.
Ark....	Fayetteville.....	Public.	Ga. ....	Winter Park.....	University of Florida.
	Jonesboro.....	University of Arizona.		Athens.....	Public.
	Little Rock.....	Hendrix College.		Atlanta.....	Carnegie Library of the Florida State Normal and Industrial School.
Calif....	Magnolia.....	University of Arkansas.	Ga. ....	Augusta.....	Rollins College.
	Pine Bluff.....	State Agricultural Schools.		Dahlonega.....	University of Georgia.
	Alturas.....	Arkansas State.		Douglas.....	Carnegie.
Colo....	Berkeley.....	State Agriculture Schools.	Ga. ....	Savannah.....	Georgia State.
	Claremont.....	Branch Nor. College.		Oxford.....	Young Men's.
	Eureka.....	Public.		Savannah.....	Georgia Agricultural College.
Conn....	Fresno.....	University of California.	Hawaii. ....	Honolulu.....	Georgia Normal and Business Institute.
	Los Angeles.....	Pomona College.		Albion.....	Emery College.
	Sacramento.....	Free Library.		Boise.....	Georgia Historical Society.
Ill. ....	San Diego.....	Free.	Idaho. ....	Moscow.....	Georgia State Industrial College.
	San Francisco.....	Public.		Pocatello.....	College of Hawaii.
	Santa Rosa.....	California State.			State Normal School.
Colo....	Stanford University.....	Free Public.	Ill. ....		Idaho State.
	Stockton.....	Mechanics Mercantile.		Belleville.....	University of Idaho.
	Boulder.....	Public.		Bloomington.....	Idaho Technical Institute.
Conn....	Colorado Springs.....	Free Public.		Chicago.....	Public.
	Denver.....	Leland Stanford Junior University.	Ill. ....		Illinois Wesleyan University.
	Fort Collins.....	Free Public.			John Crerar.
Conn....	Pueblo.....	University of Colorado.	Ill. ....		Newberry.
	Bridgeport.....	Colorado College Coburn.			Public.
	Hartford.....	Colorado State.			St. Ignatius College.
Conn....	Middletown.....	Public.			University of Chicago.
	New Haven.....	Regis College.	Ill. ....	Danville.....	Public.
	Storrs.....	University of Denver.		Evanston.....	Northwestern University.
Conn....	Waterbury.....	Agricultural College.		Freeport.....	Public.
		McClelland Public.		Galesburg.....	Free Public.
		Public.		Jacksonville.....	Public.
Conn....		Connecticut State.		Joliet.....	Public.
		Trinity College.		Lisle.....	St. Procopius College.
		Yale University.		Monmouth.....	Monmouth College.
Conn....		Wesleyan University.		Normal.....	Illinois State Normal University.
		Agricultural College.		Olney.....	Carnegie Public.
		Silas Bronson.		Peoria.....	Public.

State or Territory.	City.	Name of library.	State or Territory.	City.	Name of library.
Ill.....	Rockford.....	Public.	Me.....	Saco.....	Dyer Library Association.
	Springfield.....	Illinois State Historical Society.		Waterville.....	Colby University.
Ind.....	Urbana.....	Illinois State.	Md.....	Annapolis.....	Maryland State.
	Bloomington.....	University of Illinois.		Baltimore.....	United States Naval Academy.
	Crawfordsville.....	Indiana University.			Enoch Pratt Free.
	Evansville.....	Wabash College.			Johns Hopkins University.
	Fort Wayne.....	Willard Library.			Peabody Institute.
	Greencastle.....	Public.		Chestertown.....	Washington College.
	Hanover.....	De Pauw University.		Westminster.....	Western Maryland College.
	Huntington.....	Hanover College.	Mass...	Amherst.....	Amherst College.
	Indianapolis.....	City Free.		Boston.....	Massachusetts Agricultural College.
	Jasper.....	Public.			Athenaeum.
	La Fayette.....	Indiana State.			Public.
	Merom.....	Jasper College.			State Library of Massachusetts.
	Muncie.....	Purdue University.			Harvard College.
	Notre Dame.....	Union Christian College.		Cambridge.....	City.
Iowa....	Richmond.....	Public.		Lowell.....	Public.
	Terre Haute.....	Lemonnier Library of Notre Dame.		Lynn.....	Public.
	Ames.....	Morrison Reeves.		Marlboro.....	Public.
	Boone.....	Indiana State Normal School.		New Bedford.....	Public.
	Cedar Falls.....	Public.		Salem.....	Essex Institute.
	Council Bluffs.....	Free Public.		Taunton.....	Public.
	Des Moines.....	Public.		Tufts College.....	Tufts College.
	Dubuque.....	Carnegie-Stout Free Public.		Williamstown.....	Williams College.
	East Des Moines.....	Iowa State.		Worcester.....	American Antiquarian Society.
Kans....	Fairfield.....	Free Public.	Mich...	Ann Arbor.....	Free Public.
	Fayette.....	Upper Iowa University.		Battle Creek.....	General Library of University of Michigan.
	Grinnell.....	Iowa College.		Benton Harbor.....	Public School.
	Iowa City.....	State University of Iowa.		Detroit.....	Public.
	Mount Pleasant.....	Iowa Wesleyan University.		East Lansing.....	Detroit College.
	Mount Vernon.....	Cornell College.		Grand Rapids.....	Public.
	Sioux City.....	Public.		Houghton.....	Michigan State Agricultural College.
	Tabor.....	Tabor College.			Public.
	Baldwin.....	Baker University.		Kalamazoo.....	Library of the Michigan School of Mines.
	Emporia.....	Kansas State Normal.		Lansing.....	Public.
	Hiawatha.....	Morrill Free Public.		Muskegon.....	Michigan State.
	Lawrence.....	Spooner Library of University of Kansas.		Orchard Lake.....	Hackley Public.
	Manhattan.....	Kansas State Agricultural College.		Port Huron.....	Polish Seminary.
	Pittsburg.....	Public.		Saginaw.....	Public.
	Sterling.....	Cooper College.		Duluth.....	Hoyt Public.
	Topeka.....	Kansas State.		Faribault.....	Free Public.
		Kansas State Historical Society.		Fergus Falls.....	Public.
Ky....	Wichita.....	Fairmount College.		Minneapolis.....	High School.
	Danville.....	Centre College of Central University.			Public.
	Frankfort.....	Kentucky State.		Stillwater.....	University of Minnesota.
	Glasgow.....	Public.		St. Paul.....	Public.
	Henderson.....	Public.	Miss...	Winona.....	Minnesota Historical Society.
	Lexington.....	State University.		Agricultural College.	Minnesota State.
	Lincoln Ridge.....	Lincoln Institute of Kentucky.		Brookhaven.....	Public.
	Louisville.....	Free Public.		Greenville.....	State Normal School.
	Paducah.....	High School.		Jackson.....	Mississippi Agricultural and Mechanical College.
	Somerset.....	Carnegie Public.		Oxford.....	Public.
	Winchester.....	Kentucky Wesleyan College.			Carnegie Millsaps.
La.....	Baton Rouge.....	Hill Memorial Library of State University.	Mo....		Mississippi State.
	Natchitoches.....	State Normal School.			Mississippi State University.
	New Orleans.....	Howard Memorial.			Oxford.....
		Louisiana State.			State Normal School.
		Louisiana State Museum.			
		Public.			
		Tulane University.			
	Ruston.....	Louisiana Industrial Institute.			
Me....	Augusta.....	Maine State.		Fulton.....	University of Missouri.
	Bangor.....	Public.		Chillicothe.....	Westminster College.
	Brunswick.....	Bowdoin College.		Columbia.....	Free Public.
	Lewiston.....	Bates College.		Hannibal.....	Missouri State.
	Orono.....	University of Maine.		Jefferson City.....	Public.
	Portland.....	Public.		Kansas City.....	Rockhurst College.

State or Territory.	City.	Name of library.	State or Territory.	City.	Name of library.
Mo....	Springfield.... St. Joseph.... St. Louis.....	Drury College. Public. Christian Brothers College. Public. St. Louis University. Washington University. State Normal School.	N. C....	Chapel Hill.... Davidson..... Durham..... Greensboro.....	University of North Carolina. Union Library of Davidson College. Trinity College. Colored Agricultural and Mechanical College. Catawba College. North Carolina State. Wake Forest. Washington.
Mont...	Warrensburg.... Bozeman..... Butte..... Helena..... Missoula..... Fremont..... Grand Island..... Lincoln.....	Montana Agricultural College. Montana State School of Mines. Historical Department of Montana State. Public. University of Montana. Public. Carnegie. Library of the University of Nebraska.	N. Dak.	Agricultural College. Bismarck.....	North Dakota State. State Historical Society. State University of North Dakota.
Nebr...	Omaha..... Carson City..... Reno..... N. H....	Nebraska State. Public. Nevada State. University of Nevada. New Hampshire State. Public.	Ohio....	University..... Valley City..... Alliance.....	State Teachers' College. Mount Union Scio College. Athens..... Carnegie
Nev....	Concord..... Dover..... Durham..... Hanover..... Laconia..... Manchester..... Atlantic City..... Newark..... New Bruns-wick..... Paterson..... Princeton..... Trenton.....	New Hampshire State. Hamilton Smith Public. Dartmouth College. Public. Public.		Bucyrus..... Chillicothe..... Cincinnati..... Cleveland..... Columbus..... Dayton..... Delaware.....	Public. Public. Public. Public. Public. Ohio State. Ohio State University. Public.
N. J....	Elizabeth..... Jersey City..... Newark..... New Brunswick..... Paterson..... Princeton..... Trenton.....	Elizabeth Public Library and Reading Room. Free Public. Free Public. Free Public. Free Public.		Gambier..... Granville..... Hiram..... Lebanon..... Marietta..... Oberlin..... Oxford..... Portsmouth..... Sidney..... Springfield..... Steubenville..... Toledo..... Van Wert.....	Charles Slocum Library of Ohio Wesleyan University. Kenyon College. Denison University. Hiram College. Public.
N. Mex.	Albuquerque..... East Las Vegas..... Santa Fe..... State College.....	New Mexico State. University of New Mexico. Normal University. Territorial.	Oka...	Ada..... Altus..... Alva..... Enid..... Guthrie..... Langston.....	Brumback Library of Van Wert County. East Central State Normal School. Public.
N. Y....	Albany..... Brooklyn..... Buffalo..... Canton..... Farmington, L. I..... Glens Falls..... Hamilton..... Ithaca..... Keuka Park..... Newburgh..... New York.....	New York State. Public. Pratt Institute Free. Grosvenor. Public. St. Lawrence University. State Institute of Applied Agriculture. Crandall Free. Colgate University. Cornell University. Keuka College Public. Free. Astor Branch of New York Public. College of the City of New York. Columbia University. Lemon Branch of New York Public. New York Law Institute. New York University. The World.	Oreg...	Miami..... Muskegee..... Norman..... Oklahoma City..... Stillwater..... Tishomingo..... Corvallis..... Eugene..... Forest Grove..... Portland..... Salem..... Bradford..... Carlisle..... Erie..... Gettysburg..... Harrisburg..... Haverford..... Huntingdon.....	Colored Agricultural and Normal University. Public. High School. University of Oklahoma. Oklahoma State. Oklahoma Agricultural and Mechanical College. Murray State School of Agriculture. Oregon Agricultural College. University of Oregon. Tualatin Academy and Pacific University. Library Association. Reed College. Oregon State. Carnegie Public.
	Plattsburgh..... Poughkeepsie..... Rochester..... Schenectady..... Syracuse..... Troy..... Utica..... West Point..... Yonkers.....	Adriance Memorial. Rochester University. Union College. Syracuse University. Public. Public. United States Military Academy. Public.	Pa....	J. Herman Bosler Memorial. Pennsylvania College. Pennsylvania State. Haverford College. Junlata College.	

State or Territory.	City.	Name of library.	State or Territory.	City.	Name of library.
Pa.....	Lancaster.....	Watts De Peyster Library of F. and M. College.	Tex.....	College Station.	Agricultural and Mechanical College of Texas.
	Meadville.....	Allegheny College.		Dallas.....	Public.
	Norristown.....	William McCann.		El Paso.....	Public.
	Philadelphia.....	Free.		Fort Worth.....	Carnegie.
		Historical Society of Pennsylvania.			Texas Christian University.
	Pittsburgh.....	Library Company of Philadelphia.		Galveston.....	Rosenberg.
		Mercantile.		Georgetown.....	Southwestern University.
		Carnegie.		Houston.....	Lyceum and Carnegie.
		University of Pittsburgh.		San Antonio.....	Carnegie.
	Scranton.....	Public.		Waco.....	Baylor.
	South Bethlehem.	Lehigh University.		Logan.....	Agricultural College.
	State College..	Carnegie Library of Pennsylvania State College.		Manti.....	High School.
	Reading.....	Reading.		Ogden.....	Carnegie Free.
	Warren.....	Public.		Provo.....	Brigham Young University.
	Washington.....	Memorial Library of Washington and Jefferson College.		Salt Lake City.....	University of Utah.
	Wilkes-Barre.	Wyoming Historical and Geological Society.		Burlington.....	Fletcher Free.
P. I.....	Manila.....	Philippine Library and Museum.		Middlebury.....	University of Vermont.
R. I.....	Kingston.....	Rhode Island College of Agricultural and Mechanical Arts.		Montpelier.....	Middlebury College.
	Providence.....	Brown University.		Northfield.....	Vermont State.
		Public.			Carnegie Library of Norwich University.
	Westerly.....	Rhode Island State.		Blacksburg.....	Virginia Agricultural and Mechanical College and Polytechnic Institute.
S. C....	Charleston.....	Public.			Bridgewater College.
		Charleston College.			Emory.....
	Clemson College.	Charleston Library Society.			Emory and Henry College.
	Clinton.....	Clemson Agriculture College.		Hampden Sidney.....	Hampden Sidney College.
	Columbia.....	Presbyterian College of South Carolina.		Lexington.....	Virginia Military Institute.
		South Carolina State.			Washington and Lee University.
		University of South Carolina.			Public.
	Greenwood.....	Carnegie Public.		Norfolk.....	Richmond College.
	Orangeburg.....	Colored Normal Industrial, Agricultural, and Mechanical College of South Carolina.		Richmond.....	Virginia State.
		Winthrop Normal and Industrial College Carnegie.		Salem.....	Roanoke College.
	Rockhill.....	South Dakota State College of Agricultural and Mechanical Arts.		University.....	Virginia University.
S. Dak.	Brookings.....	Dakota Wesleyan University.		Everett.....	Public.
	Mitchell.....	South Dakota State.		Olympia.....	Washington State.
	Pierre.....	Carnegie Free Public.		Pullman.....	State College of Washington.
	Sioux Falls.....	University of South Dakota.		Seattle.....	Public.
	Vermillion.....	Yankton College.			University of Washington.
Tenn....	Yankton.....	Public.		Spokane.....	Public.
	Chattanooga.....	University of Tennessee.		Tacoma.....	Whitman College.
	Knoxville.....	Cossitt.		Walla Walla.....	Department of Archives and History, State.
	Memphis.....	Middle Tennessee State Normal.		Charleston.....	Davis and Elkins College.
	Murfreesboro.....	Nashville.....		Elkins.....	Normal School.
		Carnegie.		Fairmont.....	West Virginia Colored Institute.
		Tennessee State.		Institute.....	Keyser.....
		Vanderbilt University.			Preparatory Branch of West Virginia University.
	Sewanee.....	University of the South.			West Virginia University.
	Spring Hill.....	Branahm and Hughes School.		Morgantown.....	Salem College.
Tex.....	Austin.....	Texas State.		Salem.....	Lawrence University.
	Clarendon.....	University of Texas.		Appleton.....	Beloit College.
		Clarendon College.		Beloit.....	Public.
				Eau Claire.....	Public.
				Fond du Lac.....	Public.
				La Crosse.....	Public.
				Madison.....	State.
					State Historical Society.
				Milwaukee.....	Public.
				Racine.....	Public.
				Superior.....	Public.
				Cheyenne.....	Wyoming State.
				Laramie.....	University of Wyoming.
				Sheridan.....	Carnegie Public.

#### 8. ANNOUNCEMENTS OF NEW PUBLICATIONS.

A mailing list is maintained to which is sent at regular intervals the list of titles of new publications. Names will be added to this announcement list on request.

One of the objects of this supplement is to list new publications issued after the latest edition of Circular 24, "Publications of the Bureau of Standards." Such new publications will be listed in the succeeding editions of this supplement until it becomes desirable to revise the complete list given in C24.

SCIENTIFIC PAPERS.

S430. High-Frequency Resistance of Inductance Coils..

.....*Gregory Breit*

The meaning of the term "resistance" needs careful consideration in the case of high-frequency alternating currents. Difficulties are caused by two effects—the skin effect and the capacity effect. Capacity effects in inductance coils, which are considered in this paper, are caused by the capacities which exist between different portions of the coil, and consist in the collection of charges at points on the wires of the coil, and in the nonuniform distribution of current in the coil which these charges cause. The measured resistance of an inductance coil assumes varying values, depending upon the point with respect to which it is measured. It is shown that if the resistance with respect to all points of the coil is known, then the current at any point of the coil may be computed as soon as the distribution of emf's along the coil is assigned, and a formula is derived for this purpose. Values of current computed by this formula are checked experimentally. The computed value of the resistance is also checked experimentally. (Feb. 24, 1922.) 19 pp. Price, 5 cents.

S431. The Field Radiated from Two Horizontal Coils.

.....*Gregory Breit*

In order to facilitate the landing of airplanes, J. A. Willoughby, of the Bureau of Standards, devised a new type of radio transmitting antenna employing two horizontal coils. The behavior of this transmitting antenna is calculated in this paper. Expressions are derived for the current received in a coil antenna and in an open antenna located at a given distance from and in a given orientation with reference to the transmitting antenna. The variation of signal intensity is computed for the case of an airplane in horizontal flight over the transmitting station, and it is found that if the reception is by means of a vertical coil antenna, then a maximum signal is heard in a position in which the line joining the airplane with the transmitting antenna makes an angle of  $35^{\circ}$  with the vertical. (Mar. 10, 1922.) 18 pp. Price, 5 cents.

S432. An Improved Method for Preparing Raffinose. *E. P. Clark*

Owing to the demands made by chemists and bacteriologists for specifications and standards for raffinose, a convenient and economical method for its preparation has been developed. Cottonseed meal is extracted from water, the liquor freed from impurities with basic lead acetate, and the raffinose present removed from the liquid as an insoluble lime compound. This raffinosate is decomposed with  $\text{CO}_2$ , and the free sugar resulting is crystallized from its concentrated sirup by means of alcohol. A device for carbonating, which is useful for many other purposes, is also described. (Apr. 8, 1922.) 4 pp. Price, 5 cents.

S433. Thermal Expansion of a Few Steels.....  
*Wilmer Souder and Peter Hidnert*  
The critical regions of steel are used as a basis for heat treatment in securing or retaining desirable quantities, such as hardness, elastic properties, tensile strength, etc. Data are presented in tabular form and in curves showing the dimensional changes of steel in passing through these regions. Electrolytic iron and cast iron are also included. One specimen of hardened steel is analyzed, by dimensional changes, to show the release of strains on heating. (Apr. 10, 1922.) 16 pp. Price, 5 cents.

S434. Electromotive Force of Cells at Low Temperatures..  
*G. W. Vinal and F. W. Alstrup*  
The practical importance of a knowledge of the electromotive behavior of dry cells and storage batteries at low temperatures has arisen from their use in the Arctic and at high altitudes. Measurements were made on dry cells and storage batteries cooled to 72° C. by carbon dioxide snow and to 170° C. by the use of liquid air. The Gibbs-Helmholtz equation was applied to the observations, and excellent agreement between theory and observation found. At the lowest temperatures high values of voltage were sometimes observed and the polarity often reversed. A possible explanation based on the Nernst equation is given. (Apr. 17, 1922.) 8 pp. Price, 5 cents.

S435. Metallographic Etching Reagents: II. For Copper  
Alloys, Nickel, and the Alpha Alloys of Nickel.  
*Henry S. Rawdon and Marjorie G. Lorentz*  
This investigation constitutes the second part of the general study of metallographic etching reagents. Specimens representative of all of the types of alloys in the copper-zinc system and of the industrial bronzes and of aluminum bronze were examined. The etching characteristics of brasses and bronzes are very similar to those of copper (S399) in that oxidation plays a very important part. Nickel is etched with very considerable difficulty, contrast is usually lacking, and pitting is apt to be excessive. A new reagent, concentrated by hydrochloric acid, is described for etching this material, by means of which very superior results may be obtained. The alpha nickel alloys are etched much more readily than is the metal itself, particularly the nickel brasses. (Apr. 27, 1922.) 42 pp. Price, 15 cents.

S436. Interference Methods for Standardizing and Testing Precision Gage Blocks..  
*C. G. Peters and H. S. Boyd*  
With the interference methods described in this paper the planeness and parallelism errors of precision gage surfaces can be measured and the length of standard gages determined by direct comparison with the standard light waves with an uncertainty of not more than a few millionths of an inch. The errors of other gages can be determined by comparison with these calibrated standards, with equal precision. (May 2, 1922.) 37 pp. Price, 10 cents.

S437. The Solubility of Dextrose in Water.....  
*Richard F. Jackson and Clara Gillis Silsbee*  
The equilibria in the system, dextrose and water, have been determined. For temperatures below 90° C. three solid phases are capable of existence, namely, ice,  $\alpha$ -dextrose monohydrate, and anhydrous-dextrose. The

cryohydric point lies at the temperature  $-5.3^{\circ}\text{C}$ . and concentration 31.7 per cent dextrose. The solid phase,  $\alpha$ -dextrose, monohydrate, which occurs in lustrous plates, is stable between  $-5.3$  and  $50^{\circ}\text{C}$ . Its solubility shows a very high temperature coefficient. The observed melting point,  $80\text{--}90^{\circ}\text{C}$ ., although located far from the extrapolated solubility curve, is shown to be compatible with the measurements. The anhydrous form, stable above  $50^{\circ}\text{C}$ ., has a small solubility temperature coefficient. The solubility measurements of this phase in metastable state were continued down to  $28^{\circ}\text{C}$ . (May 5, 1922.) 10 pp. Price, 5 cents.

S438. Tests of Stellar Radiometers and Measurements of the Energy Distribution in the Spectra of 16 Stars..... *W. W. Coblentz*

An account is given (1) of the new tests of stellar radiometers, (2) of new measurements of the total radiation of stars, (3) of the spectral energy distribution in the complete spectrum of a star as determined by means of transmission screens, and (4) of estimates of the temperature of stars as determined from the spectral energy measurements. These radiation measurements indicate spectral energy distribution equivalent to that of a black body at  $3,000^{\circ}\text{K}$  for red stars to  $10,000^{\circ}\text{K}$  for blue stars. (May 12, 1922.) 26 pp. Price, 10 cents.

S439. Sensitometry of Photographic Emulsions and a Survey of the Characteristics of Plates and Films of American Manufacture..... *R. Davis and F. M. Walters, jr.*

The properties of photographic emulsions are discussed from the standpoint of the relation between density and exposure, the growth of contrast with development, color sensitiveness, resolving power, and fogging in development. The apparatus used in testing photographic material at the Bureau of Standards is described. Charts are given of 90 negative emulsions made in the United States. These charts show the characteristic curves, the rate of development curve, the growth of fog with contrast, the color sensitiveness, the filter factors, the speed, the resolving power, and scale of the various plates and films. (May 5, 1922.) 120 pp. Price, 35 cents.

S440. The Spectral Transmissive Properties of Dyes: I. Seven Permitted Food Dyes, in the Visible, Ultra-Violet, and Near Infra-Red..... *K. S. Gibson, H. J. McNicholas, E. P. T. Tyndall, M. K. Frehafer, and W. E. Mathewson*

In this paper is presented the outline of an investigation of the spectral transmissive properties of dyes. The plans and purposes of this investigation are discussed, the methods and apparatus used to obtain the data described, and a tentative nomenclature presented. Four methods are used in the experimental work: (1) the visual method, using the König-Martens spectrophotometer; (2) the photographic method, with the Hilger sector photometer; (3) the photoelectric null method; and (4) the thermo-

electric method. The total range of measurement is from 240 to 1,360 millimicrons.

As a beginning, and to illustrate the methods of obtaining and presenting the data, the transmittances of seven permitted food dyes have been obtained in the visible, ultra-violet, and near infra-red spectral regions, at different concentrations, thicknesses, and temperatures. Discussion of the analytical and theoretical applications of the data is postponed until more data are available. (May 15, 1922.) 64 pp. Price, 15 cents.

S441. Notes on Standard Wave Lengths, Spectographs,  
and Spectrum Tubes. .... *W. F. Meggers and Keivin Burns*

I. Standard wave lengths in the cadmium spectrum are presented in the range 2980 to 5085 Å. The values for 13 lines are given relative to the primary standard and are thought to be correct to one part in several millions.

II. A quartz rock salt spectograph designed for the purpose of photographing interference phenomena in the ultra-violet is described.

III. The characteristics and performance of a stigmatic concave grating mounting are outlined, and detailed drawings of the apparatus are reproduced.

IV. Instructions and suggestions are given for the preparation of spectrum tubes commonly required for optical demonstration, testing, or research. (May 24, 1922.) 15 pp. Price, 5 cents.

S442. Wave-Length Measurements in the Arc Spectra of  
Neodymium and Samarium. .... *C. C. Kiess*

This paper contains about 3,000 wave lengths measured in the arc spectra of neodymium and samarium between 5475 Å in the green and 9200 Å in the infra-red. A supplementary list contains about 125 lines common to the spectra of both elements. They may be characteristic of the element coming between neodymium and samarium, but not yet isolated. A large concave grating spectograph was used for the work, the photographic plates being suitably sensitized for the regions investigated. The materials used were neodymium oxalate and samarium oxide prepared at the University of Illinois and samarium oxalate prepared at New Hampshire College. (June 1, 1922.) 19 pp. Price, 5 cents.

S443. Measurement of the Color Temperature of the More  
Efficient Artificial Light Sources by the  
Method of Rotatory Dispersion. .... *Irwin G. Priest*

A description of measurements of color temperature by the method of rotatory dispersion for color temperatures between 3,000 and 4,000° absolute centigrade. Quantitative data are given on (1) comparison of color temperature scales at the Bureau of Standards and the Nela Research Laboratory, (2) the color temperature of the gas-filled tungsten lamp as a function of efficiency up to the melting point of tungsten, and (3) the color temperature of the carbon arc. (July 24, 1922.) 14 pp. Price, 5 cents.

S444. Practical Spectrographic Analysis. .... *W. F. Meggers*

A brief review of various methods which have been proposed for chemical analyses by means of the spectrum is followed by a detailed description of the principle, apparatus, and procedure employed in making quantitative analyses from the spectra of condensed sparks. The practical application of this method is illustrated by three samples taken from the work of the spectroscopy section of the Bureau of Standards and deals with the quantitative determination of impurities in various samples of tin, gold, and platinum. Other applications to problems in chemistry, metallurgy, mineralogy, physics, biology, etc., are suggested. (July 29, 1922.) 21 pp. Price, 10 cents.

S445. A Piezo Electric Method for the Instantaneous Measurement of High Pressures. .... *J. C. Karcher*

A number of quartz plates suitably cut are arranged, condenser fashion, in a stack and introduced in an electric circuit. The quartz plates are subjected by means of a piston to the gas pressure to be measured. The combination of these constitutes a gauge which is screwed into the wall of the gas chamber, and the leads are brought out through holes drilled through the wall. A ballistic galvanometer whose period is long compared to the duration of the pressure phenomenon is connected to the electrodes of the quartz plates. The galvanometer deflections are photographically recorded on a rapidly moving film. The pressure-time curve is the differential of the recorded deflection-time curve. (Aug. 4, 1922.) 8 pp. Price, 5 cents.

S446. Spectrophoto-electrical Sensitivity of Argentite. .... *W. W. Coblentz*

The present paper on argentite (isometric crystal) in connection with a previous paper (B. S. Sci. Paper No. 344) on acanthite (orthorhombic crystal) constitutes a study of spectrophotoelectrical sensitivity as affected by crystal structure. The paper gives experimental data on the effect of temperature, of the intensity of the radiation stimulus, and of mechanical working of the material upon photoelectrical sensitivity. From the data presented it is concluded that crystal structure has a marked effect upon spectrophoto-electrical sensitivity. (Aug. 18, 1922.) 16 pp. Price, 5 cents.

S447. Theory, Construction, and Use of the Photometric Integrating Sphere. .... *E. B. Rosa and A. H. Taylor*

Part I deals with the materials and construction of various spheres, and describes in detail the construction of a reinforced concrete sphere at the Bureau of Standards. It gives tests of the accuracy of integration by this sphere, the absorption of light by the sphere coating and by objects in the sphere, and the effect of the position of lamps. Proper methods of operation are also outlined.

Part II gives a fairly complete resumé of the general theory of the sphere, with the addition of a considerable amount of new material, showing how to test the accuracy of the sphere, and how to improve the accuracy of integration. It also gives a bibliography of the subject. (Aug. 28, 1922.) 45 pp. Price, 10 cents.

S448. The Decarburization of Ferrochromium by Hydrogen..... *Louis Jordan and F. E. Swindells*

The recent development of stainless or rustless iron—a very low-carbon stainless steel—has emphasized the demand for inexpensive, low-carbon ferrochromium. Methods of refining high-carbon ferrochromium are reviewed. Several investigations of the decarburization of iron and steel by heating in hydrogen have been reported in the literature. A similar method for the decarburization of high-carbon ferrochromium has been proposed. Decarburization takes place slowly when solid ferrochromium is heated in hydrogen at or above 1,100° C. The most rapid decarburization was secured by blowing hydrogen through molten ferrochromium. (Sept. 15, 1922.) 8 pp. Price, 5 cents.

S449. Radio-Frequency Amplifiers..... *P. D. Lowell*

The use of radio-frequency amplification makes it possible to receive very feeble signals which without such amplification can not be heard at all. For satisfactory reception with coil antennas, such as those used in direction-finding work, radio-frequency amplification is necessary. There are three important methods by which the stages of a radio-frequency amplifier may be coupled—resistance coupling, tuned-plate coupling, and transformer coupling. This paper discusses each of these methods, particularly the last method, and gives circuit diagrams and constructional details. The construction of the radio-frequency transformers and other accessory devices required in constructing the amplifier is described. Descriptions are given of radio-frequency transformers having iron cores of thin steel laminations, as well as air-core transformers. (Oct. 2, 1922.) 9 pp. Price, 5 cents.

S450. An Electron-Tube Amplifier Using Sixty-Cycle Alternating Current to Supply Power for the Filaments and Plates..... *P. D. Lowell*

Electron-tube amplifiers now form an important part of practically all radio receiving sets. The usual types of electron-tube amplifiers in general use require storage batteries and dry batteries to supply power. This paper describes the development of a special type of amplifier which uses 60-cycle alternating current from the ordinary lighting mains as a source of power for both the filaments and plates. The final form of the amplifier has three stages of radio-frequency amplification—a crystal detector and two stages of audio-frequency amplification. The inconvenience and expense of storage batteries and dry batteries are eliminated. Complete circuit diagrams are given. (Oct. 2, 1922.) 8 pp. Price, 5 cents.

S451. Spectrophoto-electrical Sensitivity of Bournonite and Pyrargyrite . . . *W. W. Coblenz and J. F. Eckford*

The present paper in connection with previously published data on proustite (Sci. Paper No. 412) represents a study of the effect of chemical constitution upon spectrophoto-electrical sensitivity. Experimental data are given on the effect of temperature and of the intensity of the radiation stimulus upon the spectrophoto-electrical sensitivity of bournonite and pyrargyrite. The results obtained are in agreement with the previously formulated (Sci. Paper No. 398) general characteristics of spectrophoto-electrical conduction in solids. (Oct. 3, 1922.) 20 pp. Price, 10 cents.

S452. The Structure of Martensitic Carbon Steels and the Changes in Microstructure which Occur upon Tempering.....*Henry S. Rawdon and Samuel Epstein*

A study of the microstructural changes produced in hardened steels by tempering was carried out in a series of six carbon steels (0.07 to 1.12 per cent carbon). The characteristic features in the visible structure of martensite are discussed, and the changes caused by heating are considered with reference to the thermal transformation in hardened steels which occurs at approximately 250° C. The microscopic study was supplemented by determinations of the sclerometer hardness, and the results were found to confirm and support the conclusions which the study of the structure appeared to warrant. (Oct. 9, 1922.) 37 pp. Price, 15 cents.

S453. The Preparation and Properties of Pure Iron Alloys: I. Effects of Carbon and Manganese on the Mechanical Properties of Iron.....  
.....*Robert P. Neville and John R. Cain*

This paper describes the preparation and mechanical properties of a series of very pure alloys of electrolytic iron, carbon, and manganese, whose compositions were so chosen as to bring out the specific effects on pure iron of additions of carbon, additions of manganese, and additions of carbon and manganese together in varying relative proportions. The maximum content each of carbon and manganese is about 1.5 per cent; the minimum, 0 per cent, or pure iron. Three-pound ingots of the alloys were made by fusion under vacuum in an electric furnace. From these ingots test specimens were made and tested in the annealed state. The influence of carbon and manganese on the mechanical properties of the alloys is shown by curves. (Oct. 16, 1922.) 33 pp. Price, 10 cents.

S454. The Action of Charred Paper on the Photographic Plate and a Method of Deciphering Charred Records.....*Raymond Davis*

A method is given for obtaining a copy of the written and printed matter on paper records that have been charred. The charred paper is placed between two fast photographic plates and kept in total darkness for one or two weeks. On development in the usual manner a copy is obtained of the ink writing and printing. It appears that the gases from the charred paper have the property of fogging the plate, the ink acts as a screen, hindering the escape of the gases. (Oct. 18, 1922.) 6 pp. Price, 5 cents.

S455. Tables for the Calculation of the Inductance of Circular Coils of Rectangular Cross Sections.....*Frederick W. Grover*

Formulas for the calculation of inductance are usually rather complicated, and computations are tedious and time consuming. Furthermore, the choice of the proper formula for a given problem is often difficult. When many calculations have to be made, tables for facilitating the calculations are practically indispensable. This paper presents tables, based on accurate known formulas, for the calculation of inductance in the very important case of circular coils of rectangular cross section. By their aid

the computation of the inductance is reduced to the simplest arithmetical operations. The method of using the tables is thoroughly explained and illustrated by examples. (Oct. 28, 1922.) 37 pp. Price, 10 cents.

S456. Spectrophoto-electrical Sensitivity of Some Halide

Salts of Thallium, Lead, and Silver.....

.....*W. W. Coblenz and J. F. Eckford*

The present paper, in connection with previous papers (Sci. Papers Nos. 451 and 462), completes a study of the effect of crystal structure, chemical constitution, and atomic weight upon photo-electrical reaction spectra. Spectrophoto-electrical sensitivity data are given on the chloride, bromide, and iodide of thallium and of silver, and the iodide of lead. The photoelectrical reaction of these salts is confined to a very narrow region of the violet end of the spectrum. The effect of increasing the atomic weight of the acid element is to shift the maximum of the photo-electrical reaction toward the long wave length. (Nov. 8, 1922.) 10 pp. Price, 5 cents.

S457. Gases in Metals: I. The Determination of Com-

bined Nitrogen in Iron and Steel and the

Change in Form of Nitrogen by Heat Treat-

ment.....*Louis Jordan and F. E. Swindells*

The nitrogen determined by the Allen method in iron alloys is that present as combined or nitride nitrogen. This method of analysis is described, and sources of errors are discussed. An increase in the amount of combined nitrogen was found to occur with heat treatment of certain irons and steels. It is probable that this increase in combined nitrogen is the result of the conversion of uncombined nitrogen to nitride nitrogen by heat treatment, and that nitrogen in two forms was originally present in the samples in which the increase took place. (Nov. 8, 1922.) 13 pp. Price, 5 cents.

S458. Apparatus for the Determination of the Magnetic

Properties of Short Bars.....*M. F. Fischer*

This paper describes the method and apparatus developed for the magnetic testing of cylindrical samples 6 mm in diameter and 10 cm in length. The method consists of a comparison of the test sample with a reference bar whose properties have been previously determined by calibration. The induction is measured by a test coil surrounding the specimen. The magnetizing force for any induction is that indicated by the corresponding induction in the reference bar and is read from the calibration curve. Values of magnetizing force corresponding to a given induction can, in general, be measured to within 5 per cent of the correct value for most materials. (Nov. 15, 1922.) 14 pp. Price, 5 cents.

S459. The Structure of Fucose.....*E. P. Clark*

The complete structure of fucose has not hitherto been known, the position of the hydroxyl group on carbon atom 5 being the part in doubt. In order to clear up this point, a lactone of the methyl tetroonic acid has been prepared, and from its optical properties the position of the hydroxyl group on carbon atom 4 of this substance, corresponding to carbon atom 5 of fucose, has been established, thus giving the complete structure of fucose. The position of the hydroxyl groups on carbon atoms 2, 3, and 4 of fucose has also been verified by a study of the optical properties of the amides of the methyl tetroonic acid and of fuconic acid (prepared for the first time), together with fuconic lactone. An improved method for preparing fucose is also recorded. (Nov. 22, 1922.) 8 pp. Price, 5 cents.

S460. Further Tests of Stellar Radiometers and Some Measurements of Planetary Radiation ..... *W. W. Coblenz*

Improvements are described in the radiometric apparatus used in measuring the radiation from celestial objects. Data are given on the radiations emitted by planets due to warming by solar radiation and due to a possible high internal temperature; also a verification of the stellar temperatures by means of transmission screens described in B. S. Sci. Papers, No. 438. The intensity of the planetary radiation, in per cent of the total radiation from a planet, is as follows: Jupiter (o), Venus (5), Saturn (15), Mars (30), and the moon (80).

The measurements obtained on the sun verify previous data indicating stellar temperatures ranging from 3,000° K for red, class M stars, to 12,000° for blue, class B stars. (Dec. 23, 1922.) 24 pp. Price, 10 cents.

S461. Spherical Aberration of Thin Lenses. *T. Townsend Smith*

This article presents the elementary theory of thin lenses, gives means for determining quickly the aberration of any thin lens for any position of the object and formulates conditions under which spherical aberrations of two thin lenses will compensate one another. A graphical solution of the problem as to the conditions under which a two-piece lens may be achromatic, free from axial spherical aberration and free from coma is included, and the shapes of lenses necessary to satisfy these different conditions are shown. (Dec. 27, 1922.) 26 pp. Price, 10 cents.

S462. Various Photo-electrical Investigations. *W. W. Coblenz*

Data are given upon: (1) The photo-electrical sensitivity of artificial preparations of molybdenum sulphide; (2) the effect of heat and electrical treatment upon the photo-electrical sensitivity of molybdenite and stibnite; (3) various artificial preparations; (4) positive and negative photosensitivity; (5) spectral response curve of Case's barium and strontium photo-electric cells; also of cuprous oxide, of lead antimony sulphide and of iodine; and (6) spectroscopic and chemical analyses of photosensitive and nonsensitive molybdenite. (Dec. 27, 1922.) 23 pp. Price, 10 cents.

S463. Preparation and Properties of Pure Iron Alloys:

II. Magnetic Properties of Iron-Carbon Alloys  
as Affected by Heat Treatment and Carbon  
Content. .... *W. L. Cheney*

A study of the variations of the magnetic properties of unusually pure iron-carbon alloys due to (1) heat treatment, viz., (a) hardening by quenching from temperatures above the critical range, and then drawing back to successively higher temperatures, (b) carefully annealing in vacuo; and (2) carbon content. The hardened alloys show certain magnetic transformations when drawn back to higher temperatures, which correspond to metallographic transformations. Comparing the magnetic properties with the carbon content, there are found certain changes in these properties as the percentage of carbon content is increased. The reluctance relationship is employed to predict the number of metallographic constituents present in the material. (Dec. 27, 1922.) 27 pp. Price, 15 cents.

## S464. Preparation and Properties of Pure Iron Alloys:

III. Effect of Manganese on the Structure of  
Alloys of the Iron-Carbon System.....*Henry S. Rawdon and Frederick Sillers, jr.*

Manganese plays at least three rôles in carbon steels, as deoxidizer, "desulphurizer," and as a hardener. This investigation deals with the third. The effect of manganese upon the structure was determined for an extensive series of alloys, C, 0 to 1.6; Mn, 0 to 2 per cent. The general effect of manganese may be described as a "restraining influence," so that even after annealing, steels have the structure and properties ordinarily found in similar steels of low manganese content after more rapid cooling. Manganese confers upon pearlite a fine grained sorbitic structure and lowers the eutectoid ratio by approximately 0.12 per cent for each per cent of added manganese. After normalizing, specimens high in manganese were much finer grained than those low in manganese; no difference in the annealed specimens was noted, however. (Dec. 27, 1922.) 17 pp. Price, 10 cents.

## S465. Composition, Purification, and Certain Constants

of Ammonia.....*E. C. McKelvy and C. S. Taylor*

Chemical tests made on eight standard American brands of commercial ammonia indicate that most commercial brands contain less than 0.1 per cent of impurities. Choosing the best commercial samples as a starting point for further purification, 15 samples were prepared, by numerous fractional distillations, for use in the determination of the various thermodynamical properties of ammonia. These samples were found to contain less than 0.01 per cent, by weight, of water from approximately 1 part in 10,000 to 1 part in 1,000,000, by volume, of noncondensing gases, and less than 0.001 per cent of other impurities. Determinations were made of the density of the solid, freezing point, and vapor pressure at the triple point. (Mar. 9, 1923.) 39 pp. Price, 10 cents.

## S466. Wave Length Measurements in the Arc Spectra of

Gadolinium and Dysprosium.....*C. C. Kiess*

Very pure gadolinium oxide and dysprosium oxalate prepared at the University of Illinois were used in studying the arc spectra of these elements from the green (5500A) out into the infra-red spectral regions. About 950 lines belonging to Gd and about 800 belonging to Dy have been tabulated. Most of these lines are faint. A band spectrum is emitted faintly by each element. (Mar. 12, 1923.) 12 pp. Price, 5 cents.

## S467. Specific Volume of Saturated Ammonia Vapor

*....C. S. Cragoe, E. C. McKelvy, and G. F. O'Connor*

This paper describes the measurement of the specific volume of ammonia vapor under saturation conditions in the temperature interval -50 to +50° C. by two methods—one, involving a direct determination of the mass of the vapor contained in a known volume; and the other, an optical method, involving measurements of the index of refraction of the vapor. The experimental results are shown to be in fair agreement with values obtained by computation from other measured thermodynamic properties of ammonia. Tables in both metric and English units are appended. (Mar. 17, 1923.) 29 pp. Price, 5 cents.

S468. Formulas and Tables for the Calculation of the  
Inductance of Coils of Polygonal Form ..... *Frederick W. Grover*

Inductance coils wound on forms such that each turn of the coil incloses a regular polygon have the advantage that, on account of the small amount of dielectric necessary for the support of the wires, energy losses in the dielectric may be made very small. In this paper formulas are derived for the calculation of the inductance of such coils, both for a single layer winding and for a multilayer winding. Tables which give the radius of a circular coil having the same inductance as the given polygonal coil are included. These enable the calculation of the inductance to be carried out by means of the existing formulas and tables for circular coils. (May 3, 1923.) 26 pp. Price, 10 cents.

S469. Directive Radio Transmission on a Wave Length  
of 10 meters ..... *Francis W. Dunmore and Francis H. Engel*

Two important means of reducing interference in radio communication are the use of short wave lengths, such as 10 m, and the use of directive types of antennas which will direct a beam of radiated waves toward the receiving station with which it is desired to communicate. Experiments embodying both of these methods have been conducted at the bureau with an electron-tube transmitting set and a directive reflecting antenna, consisting of short vertical wires arranged as the elements of a parabolic cylinder, using a wave length of 10 m. Each of the vertical wires was tuned separately to the radiated wave length, and the source was placed at the focus of the parabola. The radiated wave was found to be confined to an angle of about 40°. The paper gives construction details concerning the apparatus and circuits used, so that anyone may duplicate the results described. (Apr. 11, 1923.) 16 pp. Price, 10 cents.

S470. A Method for the Accurate Measurement of  
Short-Time Intervals ..... *Harvey L. Curtis and Robert C. Duncan*

A method is described whereby small intervals of time between events, whose occurrence can be recorded on a moving photographic film, may be determined with a high degree of accuracy. The method consists in ruling on the moving film a uniform time scale, simultaneously with the recording of the events to be studied. The time scale is obtained by throwing flashes of light on the film from a shutter controlled by a tuning fork. The paper discusses in considerable detail the type of optical system used, the necessary conditions for the most satisfactory timing lines, the sources of error inherent in the method, and the accuracy with which various time intervals can be measured. (Apr. 26, 1923.) 22 pp. Price, 10 cents.

S471. Methods of Measurement of Properties of Electrical Insulating Materials.....  
..... *J. H. Dellinger and J. L. Preston*

The Bureau of Standards has received frequent requests for information on the methods that have been found practicable in making measurements of properties of electrical insulating materials. This paper describes the various methods in use at the bureau. They include phase difference and dielectric constant, voltage effects at radio frequencies, electrical resistivities, density and moisture absorption, tensile strength, transverse strength, hardness, impact, strength, permanent distortion, machining qualities, thermal expansivity, and effects of chemicals. (May 2, 1923.) 34 pp. Price, 15 cents.

S472. Alternating-Current Resistance and Inductance of Single-Layer Coils..... *C. N. Hickman*

Formulas for the alternating-current resistance and inductance of single-layer coils are developed by use of an integral equation method. The formulas are applied to coils in which the skin effect is quite pronounced. The resistance and inductance of the coils are measured at several frequencies, and the results compared with the computed values. A simple formula for the mutual inductance of coaxial circles of the same diameter is also developed. (May 3, 1923.) 32 pp. Price, 10 cents.

S473. A Method for the Measurement of Sound Intensity..... *J. C. Karcher*

A sound-detecting device, such as a magnetophone or electrostatic transmitter, and two coils, whose mutual inductance can be varied by known amounts, constitutes a measuring instrument. The sound detector and one coil are connected to an indicating instrument, consisting of a vacuum-tube amplifier, a rectifier, and galvanometer. The emf generated in the detecting instrument is compared by substitution with emf generated in one coil when the other carries a known current. Since the sound intensity is proportional to the square of the emf generated in the detector, a means of making sound intensity measurements is presented. The necessity for the calibration of an amplifier is obviated. The instrument has a sensitivity range of about a millionfold. (May 7, 1923.) 7 pp. Price, 5 cents.

S474. Series in the Arc Spectrum of Molybdenum. *C. C. Kiess*

Analysis of the arc spectrum of Mo reveals the fact that the stronger lines belong to triplets and multiplets. The triplets have been arranged into series, and formulas of the Ritz type have been found for them. From the series limits have been calculated the resonance and ionization potentials which are of importance in certain physical and astronomical problems. The multiplets consist of 9 and 13 lines, and have been found to arise from interorbital transitions of the valence electron similar to those which result in the emission of the triplet series. (July 10, 1923.) 17 pp. Price, 10 cents.

S475. The Visibility of Radiant Energy.....  
 ..... *K. S. Gibson and E. P. T. Tyndall*

In cooperation with the Nela Research Laboratories a new determination of the visibility of radiant energy has been made by the step-by-step method, an equality-of-brightness method with little or no hue difference in the photometric field. Fifty-two observers were used, some of them common to previous investigations. The final values are similar to those obtained by other investigators. There seems to be no certain difference between the values of visibility obtained by the flicker and equality-of-brightness methods, provided the former is used under conditions as recommended by Ives and the latter does not depart too widely from these conditions. A revision of the I. E. S. mean curve is proposed which results in better agreement with the average experimental visibility data. (Aug. 11, 1923.) 61 pp. Price, 15 cents.

S476. A Study of Radio Signal Fading.....  
 ..... *J. H. Dellinger, L. E. Whitemore, and S. Kruse*

One of the difficulties encountered in radio communication at very high wave frequencies or short wave lengths, is the so-called fading of the received signals. This paper describes some tests which were made by the Bureau of Standards in cooperation with the American Radio Relay League. The observations reported by a large number of observers were analyzed and conclusions drawn as to possible relations between weather conditions and the fading and intensity of radio signals. The reports also included notes regarding the intensity of strays or atmospheric disturbances. (Sept. 25, 1923.) 40 pp. Price, 10 cents.

S477. Spectroradiometric Analysis of Radio Signals.....  
 ..... *Chester Snow*

If a radio signal is repeated at regular intervals, it will produce in a simple receiving circuit a current whose effective value may be measured. By varying the capacity in this circuit, it may be tuned successively to all frequencies within a given range, and the induced current observed. Since the circuit responds not to one frequency alone, but in varying degrees to all frequencies in a certain interval, there is some confusion in the record, caused by this overlapping. This article shows how to derive from such a record the spectral distribution of energy in the incoming wave. The method will be useful in studying the radiation actually sent out by a radio station in order to determine its interference producing qualities. (Oct. 22, 1923.) 32 pp. Price, 10 cents.

## TECHNOLOGIC PAPERS.

T208. Weighing by Substitution...*C. A. Briggs and E. D. Gordon*

This paper describes a plan for making accurate substitution weighings, applicable either to equal arm balances or compound lever scales, that has been developed in connection with the standardization of large weights of the Bureau of Standards. It has been prepared to meet a demand for an explanation of substitution weighing which has come from practical scale men in the field who have seen the plan used by the representatives of the bureau and who desire to adopt it. The description, however, will also be of interest and value to many workers in engineering and other laboratories who have occasion to weigh large objects accurately. A record form and computation sheet is presented which it will be found advantageous to follow. (Feb. 21, 1922.) 16 pp. Price, 5 cents.

T209. Thermal Stresses in Chilled Iron Car Wheels.....

.....*G. K. Burgess and R. W. Woodward*

A method is described for testing car wheels in the laboratory under conditions approximating the application of brakes on long grades and for measuring the stresses developed in the wheels due to the heating of the tread while the hub is cool. Twenty-eight wheels were tested in this manner, of which 16 failed by cracking in the plate. The maximum stresses measured were approximately equal to the tensile strength of the iron, or about 26,000 pounds per square inch. (Mar. 18, 1922.) 34 pp. Price, 5 cents.

T210. The Redwood Viscometer.....*Winslow H. Herschel*

The Redwood viscometer is the standard instrument in England for determining the viscosity of lubricating oils. By methods of calibration explained in previous papers (T100, T112, T125) the equation was obtained

$$\text{kinematic viscosity} = .00260 t - \frac{1.88}{t}$$

where  $t$  is the time of flow in seconds. This equation makes it possible to calculate tables for converting Redwood readings into readings of any other instrument for which a similar equation has been determined. (Apr. 10, 1922.) 20 pp. Price, 10 cents.

T211. Radiators for Aircraft Engines.....

.....*S. R. Parsons and D. R. Harper, 3d*

The characteristics which determine the value of the radiator in discharging its functions are considered in detail. Measurements of air flow through the core, of head resistance, of cooling power, and of geometrical characteristics are described and an exposition given of the relations between these and the conditions under which a radiator operates and its characteristics of form and construction. The work was based on special laboratory investigations, including laboratory tests of over 100 types of radiator core. A detailed record of the performance of these cores is included in the paper. (May 25, 1922.) 184 pp. Price, 50 cents.

T<sub>212</sub>. Carbon Monoxide in the Products of Combustion  
from Natural Gas Burners ..... *I. V. Brumbaugh and G. W. Jones*

Carbon monoxide is liberated with the products of combustion from natural gas burners in quantities that are dangerous to health if the flame is insufficiently aerated and the room is poorly ventilated. The quantities depend upon (1) distance of the utensil above the burner, (2) height of blue inner cone of flame, (3) type of burner, (4) flame characteristic (ratio of volume of primary air injected into burner relative to volume of gas consumed), (5) rate of consumption of gas per hour. No carbon monoxide was found where the distance of the utensil from the burner was such that the blue inner cone of the flame did not touch the utensil. Ventilation is especially important where gas is consumed. A natural gas flame will smother out if the oxygen of the atmosphere has been reduced to about 15.5 per cent. (May 1, 1922.) 20 pp. Price, 10 cents.

T<sub>213</sub>. Power Losses in Automobile Tires ..... *W. L. Holt and P. L. Wormeley*

This paper describes the dynamometer equipment used to measure the power loss or energy dissipated into heat in automobile tires operated under different conditions of axle load, inflation, pressure, speed, temperature, and tractive effort. The influence of these factors on power losses is shown graphically. (May 5, 1922.) 11 pp. Price, 5 cents.

T<sub>214</sub>. Durability of Cement Drain Tile and Concrete in  
Alkali Soils: Third Progress Report (1919-  
20) ..... *G. M. Williams*

This paper reports the results of inspection in 1919 and 1920 of experimental drain tile and concrete block installations at eight alkali-bearing projects in the West. The investigation has been carried on since 1913, and the conclusions to date are that the best quality of concrete will disintegrate when exposed to severe alkali attacks, and that installations of concrete in soils containing more than 0.1 per cent of salts of the sulphate type should be preceded by an examination of surrounding conditions. (May 19, 1922.) 32 pp. Price, 10 cents.

T<sub>215</sub>. Durability of Sole Leather Filled with Sulphite  
Cellulose Extract ..... *Roy C. Bowker*

This paper describes the preparation and testing of four lots of leather used to determine the comparative durability of sole leather filled with sulphite cellulose extract and sole leather filled with the ordinary tanning materials, such as chestnut wood extract and quebracho extract. Physical data obtained from actual service tests and chemical analyses of both the new and worn soles are presented. It is concluded that there is no difference in quality between the two leathers as reflected by the chemical analyses, and that sole leather filled with sulphite cellulose extract is as durable as leather filled with chestnut and quebracho extracts. (June 10, 1922.) 6 pp. Price, 5 cents.

T216. Properties of Electrical Insulating Materials of  
the Laminated Phenol-methylene Type.....  
..... *J. H. Dellinger and J. L. Preston*

A study has been made of the electrical properties and some of the mechanical properties of insulating materials of the laminated phenol-methylene type, such as are used in radio apparatus. The measurements include power loss at radio frequencies, dielectric constant, flash-over voltage, volume and surface resistivity, thermal expansivity, density, moisture absorption, tensile and transverse strength, elasticity, hardness, impact strength, effect of acids and alkalies, and machining properties. The materials studied were Formica, grades M, M-2, P, and R; Bakelite Dilecto, grades XX, X, and Continental Bakelite; Bakelite Micarta, grades 32-X, 21-X, 323, 213, and 21-D; and Condensite Celoron, grades 10, 15, and 20. (July 21, 1922.) 127 pp. Price, 30 cents.

T217. Photomicrography of Paper Fibers..... *R. E. Lofton*

This paper reports an investigation of the efficiency of the incandescent light as a source of illumination in photomicrography, of the value of light filters, of the proper use of the substage condenser and diaphragm, of the advantages of a camera with a long bellows over one having a short bellows, of the value of staining, choice of objectives, etc. The publication contains 30 figures, including 22 photographs and photomicrographs illustrating the points in question. (Aug. 2, 1922.) 22 pp. Price, 5 cents.

T218. Results of Some Compression Tests of Structural  
Steel Angles..... *A. H. Stang and L. R. Strickenberg*

This article presents the results of compression tests of 170 structural angles, made at the Pittsburgh branch, Bureau of Standards. The object of the tests was to determine the ultimate compressive strength of angles fastened at the ends in such way as would closely correspond to their connections in the construction of transmission towers. There was also tested a series of angles with square ends. An end fixation factor was found to represent satisfactorily the effect of different types of end connections. Using this fixation factor, the average values for large slenderness ratios were well represented by Euler's formula. The results obtained from shorter columns agreed with the experimental and theoretical results of Karman. The effect of eccentric loading was most marked at the slenderness ratios indicated by Karman's theory. (Aug. 3, 1922.) 17 pp. Price, 10 cents.

T219. Effect of Temperature, Deformation, and Rate of  
Loading on the Tensile Properties of Low-  
Carbon Steel below the Thermal Critical  
Range..... *H. J. French*

This paper gives results of tensile tests at temperatures up to 465° C. of several grades of boiler plate, describing special apparatus used. Determination of the effects of cold and blue work on the properties of these steels throughout the range given is described. Included also are results showing the effect of tensional elastic overstrain on the elasticity of different temperatures and its recovery with time. Effects of variation in rates of loading are described, together with a special apparatus, using a motion-picture camera for the work. (Aug. 22, 1922.) 47 pp. Price, 10 cents.

**T220. Test of a Hollow Tile and Concrete Floor Slab  
Reinforced in Two Directions.....**

.....*W. A. Slater, Arthur Hagener, and G. P. Anthes*

A slab 48 by 115.5 feet center to center of outer girders was loaded. The slab is divided into 18 panels, of which 6 are 16 feet square, 6 are 16 by 19.25 feet, and 6 are 16 by 22.5 feet. Measurements of deformations in steel and concrete were measured at about 1,600 places. The moments accounted for by stress in the steel were much less than the moments given by theoretical analysis. There was an increase in stress with continuation of a constant load on the slab, but the load was left in place long enough to indicate that this increase would not lead to a critical condition. (Nov. 15, 1922.) 67 pp. Price, 25 cents.

**T221. The Magnetic Susceptibility and Iron Content of  
Cast Red Brass.....*L. H. Marshall and R. L. Sanford***

An investigation was undertaken to determine the practicability of using a magnetic method for the quantitative estimation of small proportions, less than 1 per cent, of iron in cast tin red brass. The magnetic properties and microstructure for seven different samples were determined in the cast condition and as annealed at 800° C. for various periods up to 16 hours. The results showed that the magnetic properties were markedly influenced by heat treatment and were not a simple index to the iron content. (Sept. 22, 1922.) 14 pp. Price, 5 cents.

**T222. Relative Usefulness of Gases of Different Heating  
Value and Adjustments of Burners for  
Changes in Heating Value and Specific Gravity.....*Walter M. Berry, I. V. Brumbaugh,  
J. H. Eiseman, G. F. Moulton, and G. B. Shawn***

In connection with an investigation conducted by the Public Service Commission of Maryland to determine the most economic heating value standard for manufactured gas in the city of Baltimore, the Bureau of Standards conducted an extensive series of laboratory tests to determine, primarily, (1) the relative utilization efficiency of gases of different heating value, (2) the extent to which present appliances can be adapted to give good and efficient service with gases of different heating value and composition, and (3) what adjustment in appliances is necessary to give the consumers good and efficient service when different kinds of gases are mixed and there is a variation in the composition, heating value, and the specific gravity of the gas. The report discusses these questions in considerable detail. (Oct. 4, 1922.) 77 pp. Price, 25 cents.

**T223. Reclamation of Used Petroleum Lubricating Oils**

.....*Winslow H. Herschel and A. H. Anderson*

The reclamation of used oils is of increasing importance as a means of waste prevention, and the necessary apparatus is already available. The reclaimed oils will pass the usually accepted tests, but further information is needed in regard to the significance of tests for acidity, sulphur, and resistance to oxidation before it can be decided whether additional tests, and perhaps modifications of reclamation methods, are necessary. (Oct. 21, 1922.) 16 pp. Price 5 cents.

T224. Rate of Exhaustion of a Closed Tank by a Reciprocating Air Pump.....*Edgar Buckingham*

An equation is deduced for finding the number of strokes of a reciprocating air pump required to exhaust a tank of large volume down to any given fraction of atmospheric pressure, assuming that the piston and valves are tight. The resulting formula shows how clearance and valve loading affect the speed of exhaustion and the final minimum attainable pressure. (Jan. 4, 1923.) 8 pp. Price, 5 cents.

T225. A New Method for Determining the Rate of Sulphation of Storage-Battery Plates.....  
.....*G. W. Vinal and L. M. Ritchie*

The object of this investigation is to establish, if possible, a speedy and accurate method for measuring the effect of impurities in storage-battery electrolytes. Preliminary experiments, in which small cells were "poisoned" by the addition of substances to be studied, showed that accurate and consistent results were difficult to obtain. Results given in this paper show that it is possible to determine the rate of sulphation of storage-battery plates accurately by successive weighings of the plates immersed in solutions which are maintained at constant temperature. This paper presents only the fundamental theory of the method and the results of experiments on plates immersed in pure solutions. The extension of the work to include the effect produced by various impurities will be reported in a subsequent paper. (Dec. 19, 1922.) 8 pp. Price, 5 cents.

T226. A Study of Commercial Dial Micrometers for Measuring the Thickness of Paper.....  
.....*Paul L. Houston and D. R. Miller*

In this paper a study is made of the mechanisms, calibrations, areas, and parallelisms of contact surfaces and static contact pressures for different readings of nine commercial micrometers. A performance test is made on the nine instruments, and a new instrument is constructed to measure the compressibility of paper under different contact pressures and different size contacts. The results of the performance and compressibility tests show that different results may be expected from thickness tests on the same paper when different commercial micrometers are used because of their different contact pressures and different size contacts. In the conclusions, recommendations are made for the construction of a new standard micrometer. (Dec. 29, 1922.) 28 pp. Price, 10 cents.

T227. American and English Ball Clays.....*H. H. Sortwell*

The properties of the 21 American and English ball clays in use in the largest quantities in the manufacture of white-burning ceramic products were studied. The water of plasticity and volume drying shrinkage relations, amount of coarse mineral matter, strength when plastic, behavior in slips, strength in the dry state, amount of carbonaceous matter, volume and porosity relations over a wide range in temperature, and color in a standard body were determined. Comprehensive data on the clays are given, and a classification based on the properties is included. (Jan. 13, 1923.) 30 pp. Price, 10 cents.

T228. Lathe Breakdown Tests of Some Modern High-Speed Tool Steels....*H. J. French and Jerome Strauss*

Modern high-speed tool steels are classified according to chemical composition. The present general tendencies as regards proportions of those elements present which may be classed as impurities are discussed. These data are based on analysis of about 65 lots representing approximately 40 brands produced by various manufacturers during the period 1919-1922. Comparative lathe-cutting tests are reported for about 25 brands representing various type compositions. The test used is known as the "breakdown test" in which the endurance of tools is measured under fixed working conditions, and a discussion of the behavior of the different groups is given under both moderate and severe service. Measurements of power consumed by various steels in severe tests are likewise reported. A discussion is given of some of the limitations of the competitive breakdown test, and recommendations are made regarding its application. (Feb. 17, 1923.) 43 pp. Price, 15 cents.

T229. Some Tests of Steel-Wire Rope on Sheaves.....  
.....*Edward Skillman*

All of the ropes tested were marked "plow steel hoisting rope." They varied from  $\frac{5}{8}$  to  $\frac{1}{4}$  inch in diameter. One of them had been used for five years, but the others were new. Tests were made to determine the strength of the wires from the ropes, of the straight ropes with socketed ends, and of the ropes when at rest on sheaves of from 10 to 18 inches diameter. The results of the tests are given and the discussion covers the effect of the manner of loading the rope and the effect of overloading on the strength of worn rope. (Mar. 2, 1923.) 17 pp. Price, 10 cents.

T230. A Recording Chronograph for the Inverse Rate  
Method of Thermal Analysis.....*H. J. French*

This report describes an apparatus designed for direct plotting of curves for the inverse-rate method of thermal analysis, in which the time interval required for a definite temperature change and the temperature are the coordinates. The fundamentals of its construction and operation are described, and examples of typical curves produced are included. There is also given a brief discussion of the advantages obtained by its use, principally in reducing the time required for determining transformations in metals with equal or greater accuracy than when using ordinary types of chronographs. (Mar. 14, 1923.) 11 pp. Price, 5 cents.

T231. Tentative Standard Test Methods and Percentages  
of Oil and Moisture in Hair Press Cloths....  
.....*F. R. McGowan and C. W. Schoffstall*

An investigation to set suitable standard percentages of oil and moisture content of hair press cloths. A description of the fabric and its use is given. Methods of procedure for obtaining accurate percentages are outlined and the results of tests on 27 samples are given with graphs illustrating them. (Mar. 10, 1923.) 20 pp. Price, 5 cents.

T232. Shellac.....*Percy H. Walker and Lawrence L. Steele*

A description is given of the source, manufacture, uses, and common methods of testing shellac. Emphasis is laid on the extent to which shellac spirit varnishes are adulterated and the inadequacy of present methods for detecting such adulteration is shown. A new method for detecting adulteration in either flake or spirit shellac is described, and data are given on many samples of different grades. A suggested table for rating shellac samples from the data of this method is given. Recommended methods are given for the determination of such material in shellac as is insoluble in hot alcohol and for the determination of the shellac-alcohol ratio in a spirit varnish. Suggested specifications for pure orange flake shellac and pure orange shellac varnish are given. (Mar. 12, 1923.) 20 pp. Price, 5 cents.

## T233. Tests of Heavily Reinforced Concrete Slab Beams:

Effect of Direction of Reinforcement on  
Strength and Deformation.....

.....*Willis A. Slater and Fred B. Seely*

Twenty-six slab beams were tested for the purpose of determining the effect of the direction of the reinforcing bars on the stress developed and the relative values of bars and of expanded metal for use as slab reinforcement. An analysis of the mechanics involved indicates greater stresses and deflections for beams with diagonal than for those with direct reinforcement. The test results confirm in a general way the results of this analysis. For the slabs reinforced with expanded metal the distribution of cracks was better than for any of the slabs reinforced with bars. For splicing the expanded metal a lap of about 1.5 diamonds was indicated as being necessary. (Mar. 20, 1923.) 48 pp. Price, 15 cents.

T234. Methods of Measuring the Plasticity of Clays....*F. P. Hall*

Discussion of the term "plasticity" and the methods brought forward for the measurement of plasticity, the factors which each measures, the Bingham plastometer as an instrument for determining relative plasticity of clays, the need for more efficient methods of measuring plasticity. (Mar. 22, 1923.) 22 pp. Price, 10 cents.

## T235. Thermal Stresses in Steel Car Wheels.....

.....*George K. Burgess and G. Willard Quick*

The paper presents the results of special thermal stress tests made on 33-inch steel car wheels. The wheels were mounted on a hollow water-cooled axle, and the treads were heated to 380° C. by passing an electric current through a soft steel resistor which encircled the wheels. The resulting stresses were calculated from strain-gauge measurements after correcting for thermal expansion. The manner in which thermal stresses build up in wheels, the magnitude, nature, and location of the stresses are given. The wheels withstood the tests satisfactorily, and a few tested to 500° C. showed no sign of failure. The maximum stresses developed were in the extreme fibers and approximated the elastic limit of the steel. (Mar. 24, 1923.) 37 pp. Price, 15 cents.

T236. Loading Test of a Hollow Tile and Reinforced Concrete Floor of Arlington Building, Washington, D. C....*Louis J. Larson and Serge N. Petrenko*

Hollow tile and reinforced concrete panels supported on reinforced concrete beams were loaded, some to 3.8 times the design live load. Maximum stresses were those developed in slab at positions of negative moment. The effect of continued loading was well marked in the first 20 hours and comparatively small later. The beams around the edges of panels offered little resistance to torsion. The cracking of concrete and the resulting great increases of stresses in reinforcing steel showed that concrete carried considerable proportion of tensile stresses. The moment coefficients were generally small, due to low stresses, and are not proposed for design but show the relative amount of bending moments carried in both directions. The factor of safety of the construction is apparently higher than two. (Apr. 21, 1923.) 41 pp. Price, 15 cents.

T237. Aeronautic Instruments.....*Franklin L. Hunt*

This paper discusses briefly the types of aircraft instruments which have reached a state of practical development such that they have found extensive use in practice. The instruments described include: *Altitude instruments*, such as altimeters, barographs, statoscopes; *speed instruments*, such as air-speed indicators, ground-speed indicators, rate-of-climb indicators; *orientation instruments*, such as compasses, turn indicators, inclinometers; *engine instruments*, such as tachometers, pressure gauges, gasoline gauges, gasoline flow indicators, thermometers; *navigating instruments*, such as maps, dead-reckoning instruments, astronomical instruments, radio direction finder; and *special instruments* and accessories, such as oxygen instruments, recording instruments, strut and gas temperature thermometers, time pieces, manometers, hydrogen leak detectors. (May 16, 1923.) 65 pp. Price, 20 cents.

T238. Some Compressive Tests of Hollow-Tile Walls.. .  
.....*Herbert L. Whittemore and Bernard D. Hathcock*

Thirty-two tile walls, 4 feet long and 12 feet high, built of exceptionally high strength tile, were tested in compression. The walls fall into groups according to the size of tile, the construction, and the method of loading. The latter was axial for all but six walls for which the load had an eccentricity of 2 inches. About half of the walls were built with the cells vertical and the others with the cells horizontal. Tile from Ohio and from New Jersey were used. Walls with the cells vertical were stronger than where the cells were horizontal. The maximum stress sustained was quite independent of the wall thickness and the total load nearly proportional to this thickness. The walls axially loaded failed under a stress which was about one-third as large as was developed in the single tile. The eccentrically loaded walls developed only about half as great a stress as the centrally loaded specimens. (July 21, 1923.) 15 pp. Price, 5 cents.

T239. Tests of Caustic Magnesia Made from Magnesite  
from Several Sources.....

.....*P. H. Bates, Roy N. Young, and Paul Rapp*

Magnesite ores from four different sources, including both the crystalline and amorphous varieties, were calcined under various conditions and prepared for use in oxychloride cement mixtures. Each lot of caustic magnesia was tested in three flooring and two stucco formulas under actual service conditions as well as in the laboratory. The properties of chief interest were time of set, strength, linear change, and water resistance. The various ores used require different conditions of calcination in order to produce caustic magnesias of a given quality. The properties of the cement mixtures are affected to a very great extent by variations in (1) The degree of calcination of the ore; (2) type of aggregate, and (3) the relative amounts of given constituents in a mixture. (Sept. 14, 1923.) 30 pp. Price, 10 cents.

T240. Dynamometer Tests of Automobile Tires.....

.....*W. L. Holt and P. L. Wormeley*

This paper relates to a continuation of the work described in Technologic Paper No. 213, Power Losses in Automobiles Tire. Dynamometer tests have been made on a large number of tires of different makes, and large differences have been found in their properties. A study has been made to determine the cause of these differences and point out their significance. (Sept. 24, 1923.) 23 pp. Price, 10 cents.

T241. A Comparison of the Deoxidation Effects of Titanium and Silicon on the Properties of Rail Steel.....

*George K. Burgess and G. Willard Quick*

The paper gives the results of a comparison of rail steels finished with additions of ferrotitanium and ferrosilicon in the ladle. The study included the following out of the manufacturing processes of melting, teeming, and rolling of rails; tests on samples from the top and bottom ends of A rails for chemical homogeneity and soundness, various mechanical properties, and a macroscopic and microscopic survey. The results show much less segregation and somewhat greater uniformity in physical properties at the top ends of A rails treated with titanium. At the bottom ends there was practically no evidence of improvement from titanium additions as compared with silicon. Improvements by the additions of titanium seem to be mostly confined to the top portion of the ingot. (Oct. 1, 1923.) 57 pp. Price, 10 cents.

T242. Detector for Water Vapor in Closed Pipes.....

.....*E. R. Weaver and P. G. Ledig*

The electrical resistance of a thin film of a hygroscopic electrolyte is used as an approximate measure of the water vapor in the atmosphere with which the film is in contact. The detector is a very simple device easily adapted for use in high-pressure piping and other situations in which the determination of water vapor is usually attended with difficulty. Laboratory experiments showing the reliability, method of application, and limitations of the device are described. (Oct. 1, 1923.) 8 pp. Price, 5 cents.

T243. Stresses in a Few Welded and Riveted Tanks  
Tested Under Hydrostatic Pressure.....  
.....A. H. Stang and T. W. Greene

For the purpose of ascertaining the relative merits of riveted, as compared with electric-welded tanks, four steel tanks, 4 feet in diameter and 10 feet long, were tested under hydrostatic pressure. The ends of the tanks were spherical, having a radius of 4 feet. Strain-gauge measurements were made at different pressures and the stress distribution and the stress-pressure relationship obtained. The results of the hydrostatic tests proved rather unsatisfactory for comparing the relative strengths of the different types because of secondary failures. Secondary stresses, which produced failure in each case, were caused by (a) faulty design of the attachment of the spherical end to the cylindrical shell, (b) nonconformity of the shell to an accurate circular section, and (c) discontinuities in the shell for the manhole and fittings. (Oct. 13, 1923.) 24 pp. Price, 10 cents.

## CIRCULARS.

### C120. Construction and Operation of a Simple Home-Made Radio Receiving Outfit.

The construction of a very simple radio receiving equipment for radio communication on wave lengths between 600 and 200 m from high-power stations within 50 miles is described. This set may be easily constructed by anyone from materials which can be readily secured. The total cost of this equipment need not exceed \$10. A single circuit, with a crystal detector and an inductor variable by steps, is used. Instructions are given for the construction of the crystal detector, inductor, necessary switches, antenna, and other parts. Certain parts, such as the telephone receivers, must be purchased. Directions for operation are also given.

### C121. Construction and Operation of a Two-Circuit Radio Receiving Equipment with Crystal Detector.

The construction of a very simple radio receiving equipment is described which may be easily constructed by anyone from materials which are readily obtainable. The total cost of the equipment need not exceed \$15. A double circuit, composed of primary and secondary inductors, which are variable by steps, and a crystal detector are used. Instructions are given for the construction of the inductors, switches, wood parts, and crystal detector. Reference is made to Bureau of Standards Circular No. 120, which describes the construction of the other necessary parts. Certain parts, such as the telephone receivers, must be purchased. Directions for operation are also given.

### C122. Sources of Elementary Radio Information.

The recent developments in radio communication have been so rapid that much important radio information has not yet been collected in books but must be sought in periodicals and other sources. A number of important books have appeared recently and are not generally known. The Bureau of Standards is constantly receiving requests for radio information. Many of the inquiries call for the same information, and in order to facilitate the handling of such inquiries this circular has been prepared. This circular gives information concerning radio periodicals, radio books issued by various publishers, Government radio publications issued by various bureaus, including the publications of the Bureau of Standards, radio laws and regulations, and call letters, and answers a few of the most usual elementary questions concerning radio communication which are asked by the novice.

C<sub>123</sub>. United States Government Specification for White Floating Soap.

The material covered by this specification is a high-grade cake soap suitable for toilet use and for fine laundry work.

NOTE.—This specification is one of a series of specifications prepared to cover 10 different kinds of soap, each suitable for a particular purpose. The specifications were prepared under the auspices of the Bureau of Standards by a technical committee of the Federal Specifications Board in cooperation with the soap committee of the soap section of the American Specialty Manufacturers Association. The specifications, in general, cover the maximum and the minimum of the ingredients; also methods of sampling and laboratory examination, preparation of reagents, and basis of purchase.

C<sub>124</sub>. United States Government Specification for Liquid Soap.

The material covered by this specification is a clear solution of pure vegetable oil potash (or potash and soda) soap for toilet use in dispensing-machines. (See also note in abstract for C<sub>123</sub> for further data.)

C<sub>125</sub>. United States Government Specification for Soap Powder.

The material covered by this specification is a uniform mixture of soap and sodium carbonate in powdered form. It is suitable for general household work owing to its ease of application, solubility, and cleansing quality. (See also note in abstract for C<sub>123</sub> for further data.)

C<sub>126</sub>. United States Government Specification for Salt Water Soap.

The material covered by this specification is a coconut-oil soap suitable for use in both sea water and fresh water. (See also note in abstract for C<sub>123</sub> for further data.)

C<sub>127</sub>. United States Government Specification for Automobile Soap.

The material covered by this specification is a pure vegetable-oil paste soap containing no free alkali or acid and suitable for use in washing automobiles. (See also note in abstract for C<sub>123</sub> for further data.)

C<sub>128</sub>. United States Government Specification for Chip Soap.

The material covered by this specification is a high-grade soap in chip form, free from rosin and impurities. It is suitable for high-grade laundry work with soft water. (See also note in abstract for C<sub>123</sub> for further data.)

C<sub>129</sub>. United States Government Specification for Ordinary Laundry Soap.

The material covered by this specification is a well-made, uniformly mixed laundry or common soap. It is suitable for use with moderately hard water for general cleaning and laundry purposes. (See also note in abstract for C<sub>123</sub> for further data.)

**C130. United States Government Specification for Grit Cake Soap.**

The material covered by this specification is a compact cake soap containing finely divided siliceous material. Two grades are specified: (a) For fine work, such as glass and enamel; (b) for scouring and scrubbing. (See also note in abstract for C123 for further data.)

**C131. United States Government Specification for Scouring Compounds (a) and (b) for Floors, and Soap Scouring Compound (c).**

This specification covers three grades of powdered material composed of siliceous matter, sodium carbonate, and soap: (a) For fine marble floors, (b) for tile or ceramic and terrazzo floors, and (c) soap-scouring compound for general cleaning and scrubbing. (See also note in abstract for C123 for further data.)

**C132. United States Government Specification for Hand Grit Soap.**

The material covered by this specification is a high-grade cake soap containing about one-third its weight of clean, finely divided, insoluble siliceous matter. (See also note in abstract for C123 for further data.)

**C133. Description and Operation of an Electron-Tube Detector Unit for Simple Radio Receiving Outfits.**

The apparatus now used (1922) for radio reception, except the most simple types, uses electron tubes. The tube may be used as a simple detector, or may be used in more complicated circuits employing various kinds of amplification, or regeneration, beat reception, or other methods. A set employing an electron-tube detector is more sensitive than a set employing a crystal detector and may be expected to give more satisfactory results. This circular describes a simple electron-tube detector receiving set and gives a method of operating it. An antenna, lightning switch, ground connection, and telephone receivers, which can be used with this set, are described in Circular 120. Tuning devices for use with this electron-tube detector unit have been described in Circulars 120 and 121. A number of the parts of the detector unit should be purchased. A complete description of the method of assembling and wiring the detector unit is given. Illustrations are given showing the arrangement of the various parts and the complete assembled detector unit. Detailed instructions for operating the set are also given.

**C134. United States Government Specification for Fire-Extinguishing Liquid (Carbon Tetrachloride Base).**

This specification was prepared by a technical committee of the Federal Specifications Board. Before final approval it was submitted to the Underwriters' Laboratories and to a large number of manufacturers of such products, whose suggestions were carefully considered. The specification covers the general conditions, appearance, specific gravity, cold test, distillation test, impurities, sampling, and methods of testing.

**C135. Caustic Magnesia Cement.**

A brief summary of the discovery, early history, and later application of the reaction of caustic magnesia with solutions of magnesium chloride. The result of this reaction produces a quick hardening cement used in the stucco, flooring, and ship-decking trade. Short descriptions are given of the ore used, methods of calcining the ore, also suggested formulas for several types of products, the general qualities of these, and the lines along which specifications for the cement are being developed.

**C136. Specification for Numbered Cotton Duck for Government and Commercial Use.**

Specifications are given including weave, width, weight, count, ply, and breaking strength, also an expression as to what constitutes a good delivery. These specifications were drawn up by the Cotton Duck Association and the Bureau of Standards after extensive research, valuable assistance being given by other Government departments.

**C137. Auxiliary Condensers and Loading Coil Used With Simple Homemade Radio Receiving Outfits.**

This is the fourth circular in a series of descriptions of very simple radio receiving outfits which will receive radio telephone signals and also radio telegraph signals, except those transmitted by the use of uninterrupted continuous waves. In Circular No. 120 a single-circuit receiving set was described, and in Circular No. 121 a two-circuit set was described. The operation of either can be improved by the use of a very simple and cheap condenser connected across the telephone receivers and a similar one connected in series with the antenna. Longer waves can be received by the use of a very simple type of loading coil. The coil is particularly useful in connection with the single-circuit receiving set.

**C138. A Decimal Classification of Radio Subjects—An Extension of the Dewey System.**

This circular gives a decimal classification of radio subjects which was developed at the Bureau of Standards about two years ago. This classification is suggested as an extension of the Dewey decimal system and has been found to be very useful in classifying radio references, drawings, books, and reports. Radio communication is divided into a general class and a number of specific classes, each with appropriate subdivisions. An abbreviated classification is suggested for those readers who have only a small amount of material to classify. This may then be gradually extended as the needs of the user dictate. An index is also provided.

**C139. United States Government Specification for Dry Cells.**

This specification is a revision of that originally published in the first edition of Circular No. 79. Much additional experience has been gained in testing dry cells since the specification was first issued, and a revision was deemed desirable. The Bureau of Standards called a conference of representatives of manufacturers, Government departments, and a few of the largest individual users of dry cells and flashlight batteries, to consider the standardization of sizes and a revision of specifications for them. This conference met at the bureau on December 5 and 6, 1921. A limited number of the most important sizes were standardized and tests defined. The bureau was asked to complete the revision of the specification and to submit it to the members of the conference for criticism. This has been done. This specification includes the dimensions as agreed upon.

**C140. United States Government Specification for Wood Screws.**

This specification covers flat, round, and oval head types, together with the numbers, diameters, threads per inch, methods of measuring diameters and lengths, tolerances, and the standard sizes of brass and steel wood screws. The requirements of this specification are standard, and were drawn with the assistance and approval of the manufacturers.

**C141. Description and Operation of an Audio-Frequency Amplifier Unit for Simple Radio Receiving Outfits.**

This is the fifth circular in a series of descriptions of very simple radio receiving outfits. In Circular No. 133 an electron-tube detector unit to be used in conjunction with the single-circuit set (Circular No. 120) or with the two-circuit set (Circular No. 121) is described. This circular describes an audio-frequency amplifier unit, one or two of which may be used with the apparatus just mentioned, to increase the receiving radius of the station, as well as the volume of sound in the telephone receivers.

**C142. Tables of Thermodynamic Properties of Ammonia.**

These tables of the thermodynamic properties of saturated and superheated ammonia are based on measurements made at the Bureau of Standards. The tables have been put in convenient form for use in engineering practice, and the same data are given in graphic form as a Mollier chart. The range of temperature and pressure covered by the tables is greater than that usually encountered in the use of ammonia as a refrigerating medium.

**C143. Recommended Specification for Quicklime for Use in Causticizing.**

A brief description of the way in which lime is used in causticizing is followed by a general statement as to the quality of lime required. The standard of quality for lime for this purpose is set at 85 per cent available lime. Any shipment containing less than 70 per cent available lime or more than 3 per cent magnesia should be rejected as uneconomical to use. Complete directions for sampling, testing, and retesting are included.

**C144. Recommended Specification for Limestone and Quicklime for Use in the Manufacture of Sulphite Pulp.**

Limestone or quicklime is used to prepare the cooking liquor in which wood is cooked to reduce it to paper pulp. It is customary to use a high calcium limestone when preparing liquor by the tower process, or a high magnesian quicklime with the tank process, but other kinds of limestone or quicklime are being used. The specification, therefore, covers high calcium and high magnesian limestone and quicklime, on a basis of about 95 per cent purity.

**C145. Summary of Technical Methods for the Utilization of Molasses, Collated from Patent Literature, for the Use of the American Sugar Industry.**

Economic conditions the world over have made it generally recognized that the future of the American beet-sugar industry is to a great extent dependent on the profitable utilization of the molasses produced. The latter contains numerous valuable substances which have never been successfully recovered outside of Germany. For many years that country has seen fit to veil its developments and discoveries and to maintain the strictest secrecy regarding the operation of its molasses plants. The scientific literature on the subject is practically barren, so far as the actual results achieved in Germany are concerned. In order to carry out the necessary experimental work for the American industry, every possible source of information has been investigated. After a few clues were obtained, the U. S. Patent Office literature was searched and eventually over 1,000 German patents on molasses utilization and associated subjects were uncovered. The difficulty in locating these patents was due to the fact that they are not listed under sugar or molasses or subjects that were known to the bureau's investigators. The value of the information contained in many of these patents was so apparent and the necessity for knowledge of their contents was so obvious that the present résumé of the more important patents on the recovery of the nonsugars has been compiled.

**C146. United States Government Specification for Water Resisting Red Enamel.**

This specification was prepared by the technical committee on paints of the Federal Specifications Board after careful consideration of suggestions from manufacturers. The specification calls for an extremely durable, highest quality, red enamel, suitable primarily for outside use. Details as to general requirements, methods of sampling, and testing are included.

**C147. United States Government Specification for Gloss Interior Lithopone Paint. White and Light Tints.**

This specification was prepared by the technical committee on paints of the Federal Specifications Board, after carefully considering suggestions from paint manufacturers. This specification relates to paints not intended for outside exposure. They shall dry to gloss opaque coats that will adhere well to wood, metal, and plaster; stand washing with soap and water; and show no yellowing when kept in the dark. Detailed directions for sampling and testing are included.

**C148. United States Government Specification for Leather Belting.**

United States Government specifications for leather belting developed by the Bureau of Standards, subcommittee on leather products of the Federal Specifications Board, and a committee representing the manufacturers. Standard specification relative to the quality of the leather and construction of the belting is included. Physical and chemical requirements are provided, which serve as standards of quality, together with methods for making the tests.

#### SIMPLIFIED PRACTICE RECOMMENDATIONS.

##### R1. Elimination of Waste—Simplified Practice Recommendation No. 1.—Paving Bricks.

Specific example of the application of the principle of simplification to the paving brick industry. Describes the need for eliminating economic waste caused by the excessive variety in types and sizes of paving bricks and shows the procedure used in reducing existing varieties from 66 to 7.

The industry initiated the action through its trade association, and the Government, through the Department of Commerce, indorses and publishes as its own those simplifications recommended by joint conferences of producers, distributors, and users of the commodity.

These simplified practice recommendations when accepted by the entire industry serve as commercial standards of practice with consequent benefit through decreased stocks, costs, and investments, and increased sales, turnover, and income.

In order to further simplify the production of paving brick, the conference of 1923 eliminated an additional type of brick, reducing the 7 recognized types and sizes to 6. This procedure was based upon a resurvey by the Paving Brick Association, which showed that 80 per cent of the entire production during 1922 was within the 6 varieties.

##### R2. Elimination of Waste—Simplified Practice Recommendation No. 2—Bedsteads, Springs, and Mattresses.

Since the inception of the division of simplified practice, conferences of representatives of manufacturers, distributors, and users are held to determine and eliminate excess varieties and types of products with a view to simplifying their lines in the production of commodities. On May 15, 1922, representatives of the bed, spring, and mattress industry convened at the department in cooperation with the division of simplified practice, and adopted four standard widths of beds of one standard length, springs and mattresses to conform therewith. These recognized sizes and types will be considered as standards, subject to annual revision by a similar conference.

#### MISCELLANEOUS PUBLICATIONS.

##### M49. Graphic Comparison of Screw Thread Pitches.

A graphic chart is given showing the number of threads per inch and pitch in millimeters for both inch and millimeter systems. A simple method permits finding the nearest equivalent of one system in terms of the other. A table is printed with the chart from which values may be given more closely than can be shown in the chart and for those who prefer to use a tabulated statement. 1 p. Price, 5 cents.

##### M50. Annual Report of the Director of the Bureau of Standards to the Secretary of Commerce for the Fiscal Year Ended June 30, 1922.

In addition to the statement contained under M34, it should be stated that the present report emphasizes particularly the relation of the Bureau of Standards to the industries of the country. During the fiscal year covered by this report particular effort was made to solve such industrial problems as the elimination of unnecessary waste, the simplification of sizes, and the application of the results of research work to the practical problems of manufacturing. The work of two new divisions is described for the first time in this report; that is, the division of building and housing and the division of simplified practice. 298 pp.

##### M51. Fifteenth Annual Conference on the Weights and Measures of the United States.

Contains: addresses by the Secretary of Commerce; the chairman, Committee on Coinage, Weights, and Measures, House of Representatives; and the president of the conference; papers and discussions on subjects such as method of test of gasoline-measuring, linear-measuring, and leather-measuring devices, a uniform ton for coal, standard weight bread, the elimination of dry measures from commercial use, protection of highways by means of portable weighing devices, equipment for testing heavy-capacity scales, wholesale deliveries of gasoline especially by vehicle tanks, Federal and State approval of type of apparatus, relationship between officials and merchants and manufacturers, and manufacture of precision standards. Reports were made on the accuracy of and tolerances for heavy-duty automatic scales, and tolerances for bread and for linear-measuring devices, the latter being tentatively adopted. 148 pp. Price, 15 cents.

##### M52. Mollier Chart of Properties of Ammonia.

This chart presents, in graphic form, a complete table of the thermodynamic properties of ammonia, over the range of temperature and pressure useful in refrigerating engineering. It provides a rapid and convenient means for the solution of practical problems, and its accuracy is ample for this purpose. The chart itself is about 9 inches high by 23 inches wide. 1 p. Price, 5 cents.

M53. Annual Report of the Director of the Bureau of Standards to the Secretary of Commerce for the Fiscal Year Ended June 30, 1923.

The arrangement of this report differs from previous annual reports. The first portion deals with the functions and organization of the bureau and its relations to the Government, to the industries, and to the public. Some of the more important lines of work carried out during the year are briefly mentioned.

Detailed reports of the work of the various divisions are given as heretofore, the names of those in charge of organization units and investigations being added. At the beginning of each division's report there is given a summary of the functions, expenditures, staff, publications issued, etc. These summaries are immediately followed by a work chart giving the status of all tests and researches on June 30, 1923.

During the year 100 conferences were held between the bureau and representatives of American industries; 19 research associates were maintained in the bureau by industrial associations and manufacturers; approximately 127,000 tests were made; and 91 new publications were issued. The funds received during the year (including funds transferred from other departments) totaled \$1,719,156.92. The bureau staff comprised 896 employees.

On December 31, 1922, Dr. S. W. Stratton, director of the Bureau of Standards since its establishment in 1901, resigned. Dr. George K. Burgess, formerly chief of the metallurgical division, was appointed as his successor.

**Special publication: Recommended Minimum Requirements for Small Dwelling Construction.**

The report describes circumstances leading to appointment of Department of Commerce Building Code Committee; preliminary investigational work carried on by committee; details of measures for obtaining information on special questions; and cooperation extended by various interested organizations. It presents complete requirements for construction of small dwellings, in form suitable for adoption by States and cities. The requirements include sections on masonry walls of all types used in such structures; frame dwellings, with and without veneer of brick, stone, or stucco; wood framing in masonry structures; floor and roof loads; plastering; fire-stopping; and chimney construction.

A voluminous appendix is added to the report which explains reasons for many of the provisions recommended and gives much practical information on building materials and methods and also includes numerous illustrations of approved building practice. (July 20, 1922.) 108 pp. Price, 15 cents.

## 9. SUBJECT INDEX TO NEW PUBLICATIONS.

The consolidated index in Circular 24 is designed to include citations to titles, cross references, and subsidiary topics of all printed publications of the bureau listed in that circular. The following index supplements the index in Circular 24 by giving the additional index references to cover new publications announced in this supplement. The circular and supplement and the two indexes contained therein cover all bureau publications up to the date the supplement goes to print.

<p>Aberration, spherical, of thin lenses, S<sub>461</sub>.      Absorption of radio waves, S<sub>476</sub>.      Acid, benzoic acidimetric standard, C<sub>25</sub>.      Acidimetric standard, benzoic acid, C<sub>25</sub>.      Acidimetry, sodium oxalate as standard, C<sub>25</sub>.      Acidity of oils, T<sub>223</sub>.      Action of alkali on concrete, T<sub>214</sub>.          photographic, of charred paper, S<sub>454</sub>.      Aeronautic instruments, T<sub>237</sub>.      Air flow in radiators, T<sub>211</sub>.          pump, reciprocating, rate of exhaustion by, T<sub>224</sub>.      Air-core transformer, S<sub>449</sub>.      Aircraft-engine radiators, T<sub>211</sub>.          instruments, T<sub>237</sub>.      Airplane landing signals, radio, S<sub>431</sub>.      Air-speed indicators, T<sub>237</sub>.      Alkali soils, cement tile durability, T<sub>214</sub>.          concrete durability, T<sub>214</sub>.      Alloys, iron-carbon, magnetic properties of, S<sub>463</sub>.          pure iron with carbon and manganese, S<sub>453</sub>.      Alpha alloys etching reagents, S<sub>435</sub>.      Alternating-current resistance and inductance of solenoids, S<sub>472</sub>.          supply, S<sub>450</sub>.      Altimeters, T<sub>237</sub>.          and barometers, testing of, C<sub>46</sub>.      Aluminum melting point standard, C<sub>25</sub>.      Amateur, effect of fading on reception by, S<sub>476</sub>.          radio licenses, C<sub>122</sub>.              receiving set, C<sub>133</sub>.              wave fading, S<sub>476</sub>.      American ball clays, T<sub>227</sub>.      Amplifier, audio-frequency, C<sub>141</sub>.          electron tube, C<sub>141</sub>.      Ammonia, composition, purification, and certain constants, S<sub>465</sub>.          from beet sugar waste water, C<sub>145</sub>.      Mollier chart, M<sub>52</sub>.          specific volume of saturated vapor, S<sub>467</sub>.          tables and Mollier chart of thermodynamic properties of, C<sub>142</sub>.      Analysis, spectrographic, S<sub>444</sub>.          volumetric, C<sub>25</sub>.      Analyzed samples, C<sub>25</sub>.          See also Standard samples.</p>	<p>Aneroid barometers and altimeters, testing of, C<sub>46</sub>.      Angles, T<sub>218</sub>.      Annual Report of Director, 1922, M<sub>50</sub>.      Antenna, coil, S<sub>431</sub>.      Antennas coil, transmission from, S<sub>431</sub>.      Antimony, photoelectrical properties of sulphide of, S<sub>322</sub>, S<sub>398</sub>, S<sub>62</sub>.      Apparatus for high-temperature tensile tests, T<sub>219</sub>.      Approval-of-type legislation, M<sub>51</sub>.      Arc spectra, S<sub>466</sub>.          of neodymium, S<sub>442</sub>.          samarium, S<sub>442</sub>.          spectrum of molybdenum, S<sub>474</sub>.      Argentite, S<sub>446</sub>.      Ascophyllum nodosum, fucose from, S<sub>459</sub>.      Atmospheric electricity, relation to radio transmission, S<sub>476</sub>.      Atmospherics, relation to radio reception, S<sub>476</sub>.      Audio-frequency amplification, S<sub>449</sub>, S<sub>450</sub>.      Automatic scales, M<sub>51</sub>.      Automobile tire loss, T<sub>213</sub>.        "B" battery, S<sub>450</sub>.      Babbitt metal, standards for analysis, C<sub>25</sub>.      Balancing resistances, S<sub>450</sub>.      Ball clays, T<sub>227</sub>.      Banked windings, inductance coils, S<sub>455</sub>.      Barium, Case's photo-electric cells, S<sub>462</sub>.      Barium fumigate, preparation of, S<sub>459</sub>.      Barographs, T<sub>237</sub>.      Barometers and altimeters, testing of, C<sub>46</sub>.      Barometric conditions, effect on radio transmission, S<sub>476</sub>.      Basket-woven inductance coils, S<sub>455</sub>.      Batteries, dry, specifications for, C<sub>139</sub>.          sulphation of plates, T<sub>225</sub>.      Beds, sizes, R<sub>2</sub>.      Belting, leather, C<sub>148</sub>.      Benzoic acid, acidimetric standard, C<sub>25</sub>.          standard for combustion, C<sub>25</sub>.      Boiler plate, T<sub>219</sub>.      Bomb calorimetry, standards for, C<sub>25</sub>.      Books, radio, C<sub>122</sub>.      Bournonite, S<sub>451</sub>.      Brass containing iron, T<sub>221</sub>.          magnetic susceptibility, T<sub>221</sub>.</p>
--	---

Brass corrosion, standard for analysis, C<sub>25</sub>.  
 Brasses, etching characteristics, S<sub>435</sub>.  
 Bread tolerances, M<sub>51</sub>.  
 Bricks, paving, R<sub>1</sub>.  
 Brinell hardness numerals, table of, S<sub>471</sub>.  
 Bronze standard for analysis, C<sub>25</sub>.  
 Bronzes, etching characteristics, S<sub>435</sub>.  
 Building code committee report, Special Pub.  
 Bulletin, Radio Service, C<sub>22</sub>.  
 Bureau of Standards, *see* Annual report.  
     standard samples, C<sub>25</sub>.  
 Butterworth, inductance formulas, S<sub>455</sub>.  
 By-product recovery from beet-sugar waste water, C<sub>145</sub>.

Cadmium spectrum wave lengths, S<sub>441</sub>.  
 Call letters, radio, C<sub>122</sub>.  
 Candlepower, mean spherical, measurement by sphere, S<sub>447</sub>.  
 Cane sugar, standard, C<sub>25</sub>.  
 Capacity of inductance coils, S<sub>430</sub>.  
 Capacity, polygonal inductance coils, S<sub>468</sub>.  
 Car wheels, steel, thermal stresses in, T<sub>235</sub>.  
     thermal stresses, T<sub>209</sub>.  
 Carbon content, effect of, on magnetic properties of iron-carbon alloys, S<sub>463</sub>.  
     effects on pure iron, S<sub>453</sub>.  
     monoxide from natural gas burners, T<sub>212</sub>.  
         in products of combustion, T<sub>222</sub>.  
         steels at high temperatures, T<sub>219</sub>.  
         tetrachloride base for fire extinguishers, C<sub>134</sub>.  
 Carbonating apparatus, S<sub>432</sub>.  
 Cast bronze, standard for analysis, C<sub>25</sub>.  
     red brass containing iron, T<sub>221</sub>.  
 Catalog, radio subjects, C<sub>138</sub>.  
 Causes for rejection of duck, C<sub>136</sub>.  
 Causticizing, quicklime for use in, C<sub>143</sub>.  
 Cells, electromotive force of, S<sub>434</sub>.  
 Cellular windings, inductance coils, S<sub>455</sub>.  
 Cellulose, sulphite, extract, T<sub>215</sub>.  
 Cement, T<sub>239</sub>.  
     caustic magnesia, C<sub>135</sub>.  
     standards for testing sieves, C<sub>25</sub>.  
     tile durability in alkali soils, T<sub>214</sub>.  
 Characteristics of American plates and films, S<sub>439</sub>.  
 Charred records, deciphering, S<sub>454</sub>.  
 Chemical properties of electrical insulating materials, T<sub>216</sub>.  
 Chrome-vanadium steels, standard for analysis, C<sub>25</sub>.  
 Chromium, *see* Ferrochromium, S<sub>448</sub>.  
 Chronograph, recording for inverse rate, method of thermal analysis, T<sub>230</sub>.  
 Circuits, radio-frequency, for measurements, S<sub>471</sub>.  
 Circular coils, inductance, S<sub>455</sub>.  
 Clays, methods of measuring plasticity of, T<sub>234</sub>.  
     properties of, T<sub>227</sub>.  
 Classification, radio, C<sub>138</sub>.  
 Coil antenna, S<sub>431</sub>.  
 Coils, high-frequency resistance, S<sub>430</sub>.  
     horizontal, field radiation of, S<sub>431</sub>.  
     inductance of, S<sub>468</sub>.  
     polygonal, S<sub>468</sub>.  
     single-layer alternating current, resistance and inductance of, S<sub>472</sub>.  
     use at high frequencies, S<sub>430</sub>.

Color of illuminants, S<sub>443</sub>.  
     sensitiveness, S<sub>439</sub>.  
     temperature, S<sub>443</sub>.  
         precision and accuracy, S<sub>443</sub>.  
 Colorimetry, S<sub>443</sub>.  
     standards, C<sub>25</sub>.  
 Columns, T<sub>218</sub>.  
 Combustion, standard samples, C<sub>25</sub>.  
 Commercial micrometers, T<sub>226</sub>.  
 Comparison, graphic, of screw thread pitches, M<sub>49</sub>.  
 Compasses (aircraft), T<sub>237</sub>.  
 Composition flooring, C<sub>135</sub>.  
     purification and certain constants of ammonia, S<sub>465</sub>.  
 Compression tests, T<sub>218</sub>.  
 Concrete-block tests, T<sub>214</sub>.  
     durability in alkali soils, T<sub>214</sub>.  
     slab beams reinforced diagonally, T<sub>233</sub>.  
 Condenser, series-antenna, C<sub>137</sub>.  
     telephone-shunt, C<sub>137</sub>.  
 Constants, ammonia at the triple point, S<sub>465</sub>.  
 Construction of simple electron-tube detector, C<sub>133</sub>.  
     radio receiving outfit, C<sub>120</sub>.  
 Contrast, photographic, S<sub>430</sub>.  
 Cooling power of aircraft radiators, T<sub>211</sub>.  
 Copper alloys, etching reagents, S<sub>435</sub>.  
     impurities in, C<sub>73</sub>.  
     mechanical properties of, C<sub>73</sub>.  
     metallography, C<sub>73</sub>.  
     physical properties of, C<sub>73</sub>.  
     standard for melting point, C<sub>25</sub>.  
     statistics of production, price, etc., C<sub>73</sub>.  
     technology of, C<sub>73</sub>.  
     typical specifications, C<sub>73</sub>.  
 Cotton duck, specification, C<sub>136</sub>.  
 Crystal detector, S<sub>450</sub>, C<sub>121</sub>.  
     radio outfit, C<sub>120</sub>.  
 Cuprous oxide, spectrophotoelectrical sensitivity of, S<sub>462</sub>.  
 Current sheet, polygonal, inductance, S<sub>468</sub>.  
 Cutting tests, high-speed steels, T<sub>228</sub>.  
 Cyanides from beet-sugar waste water, C<sub>145</sub>.

"Dead spots" and radio reception, S<sub>476</sub>.  
 Decarburization of ferrochromium by hydrogen, S<sub>448</sub>.  
 Decimal classification, radio, C<sub>138</sub>.  
 Deciphering charred paper records, S<sub>454</sub>.  
 Density, electrical insulating materials, measurement, S<sub>471</sub>.  
     photographic, S<sub>439</sub>.  
     saturated ammonia vapor, S<sub>467</sub>.  
 Deoxidation of rail steel, T<sub>241</sub>.  
 Depth of focus, T<sub>217</sub>.  
 Detector, electron-tube unit, C<sub>133</sub>.  
     crystal, C<sub>121</sub>.  
     for water vapor, T<sub>242</sub>.  
 Determination, magnetic, of iron in brass, T<sub>221</sub>.  
 Dewey decimal classification, C<sub>138</sub>.  
 Dextrose, standard sample, C<sub>25</sub>.  
     solubility in water, S<sub>437</sub>.  
 Dial micrometers, T<sub>226</sub>.  
 Dielectric constant, insulating materials, measurement, S<sub>471</sub>.  
     of electrical insulating materials, T<sub>216</sub>.  
 Dielectric losses, use of polygonal coils, S<sub>468</sub>.

Directional variations, of radio signals, S<sub>476</sub>.  
 Directive radio transmission measurements, S<sub>469</sub>.  
 Director's annual report for 1922, M<sub>50</sub>.  
 Disintegration of concrete by alkali, T<sub>214</sub>.  
 Disk coils, inductance, S<sub>455</sub>.  
 Distortion of electrical insulating materials, T<sub>216</sub>.  
 Distributed capacity of inductance coils, S<sub>430</sub>.  
 Diurnal variations, of radio signals, S<sub>476</sub>.  
 Drain tile tests, T<sub>214</sub>.  
 Drop tests of car wheels, T<sub>209</sub>.  
 Dry cells, C<sub>79</sub>.  
     specifications for, C<sub>139</sub>.  
 Dry distillation apparatus, C<sub>145</sub>.  
 Duck, specification, C<sub>136</sub>.  
 Duodecagonal coils, inductance, S<sub>468</sub>.  
 Duclateral inductance coils, S<sub>455</sub>.  
 Durability of cement tile in alkali soils, T<sub>214</sub>.  
     concrete in alkali soils, T<sub>214</sub>.  
     sole leather, T<sub>215</sub>.  
 Dwelling construction, requirements, Special Pub.  
 Dwight, inductance formulas, S<sub>455</sub>.  
 Dyes, spectral transmittancy of, S<sub>440</sub>.  
 Dynamometer for tire tests, T<sub>213</sub>.  
     tests, T<sub>240</sub>.  
 Dysprosium, S<sub>466</sub>.

Eccentric loading of hollow tile walls, T<sub>238</sub>.  
 Effect, time on strains in concrete and reinforcement, T<sub>236</sub>.  
 Elasticity of wire rope, T<sub>229</sub>.  
 Electric arc, color temperature of, S<sub>443</sub>.  
 Electrical characteristics of dry cells, C<sub>79</sub>.  
     insulating materials, T<sub>216</sub>.  
     properties of insulating materials, measurement, S<sub>471</sub>.  
 Electrolytic water vapor detector, T<sub>242</sub>.  
 Electromotive force, cells, S<sub>434</sub>.  
     at low temperatures, S<sub>434</sub>.  
 Electron-tube amplifier, C<sub>141</sub>.  
     detector, C<sub>133</sub>.  
 Emanations, charred paper, sensitivity of photographic materials to, S<sub>454</sub>.  
 Emulsions, photographic, sensitometry of, S<sub>439</sub>.  
 Enamel, red, United States specifications for, C<sub>146</sub>.  
     water, resisting, C<sub>46</sub>.  
 Endurance, high-speed lathe tools, T<sub>228</sub>.  
 Energy distribution, S<sub>477</sub>.  
 Energy distribution measurements of star spectra, S<sub>438</sub>.  
 Engines, aircraft, radiators for, T<sub>211</sub>.  
 English ball clays, T<sub>227</sub>.  
 Equal-area coil, inductance calculations, S<sub>468</sub>.  
 Equal-perimeter coil, inductance calculations, S<sub>468</sub>.  
 Equilibria of dextrose in water, S<sub>437</sub>.  
 Etching, metallographic, reagents, S<sub>435</sub>.  
 Exhaustion by reciprocating air pump, rate of, T<sub>224</sub>.  
 Expanded metal, tests of slabs reinforced with, T<sub>233</sub>.  
 Expansion, thermal, of steels, S<sub>433</sub>.  
 Exposure, relation to photographic density, S<sub>439</sub>.  
 Extract, sulphite cellulose, T<sub>215</sub>.  
 Eye, sensibility, S<sub>475</sub>.  
 Eyes of industrial workers, national safety code for protection of, H<sub>2</sub>.

Fabric-measuring devices, M<sub>51</sub>.  
 Factors of power loss in automobile tires, T<sub>213</sub>.

Fading, effect on radio reception, S<sub>476</sub>.  
     theory of, S<sub>176</sub>.  
 Failure of car wheels, T<sub>209</sub>.  
 Ferrochromium, decarburization by hydrogen, S<sub>448</sub>.  
 Fibers, stained for photomicrography, T<sub>217</sub>.  
 Field radiated from horizontal coils, S<sub>431</sub>.  
 Fifteenth conference on weights and measures, M<sub>51</sub>.  
 Films, American, characteristics of, S<sub>439</sub>.  
 Filter factors, optical, S<sub>439</sub>.  
 Filters, light, T<sub>217</sub>.  
 Fire-extinguishing liquid, C<sub>134</sub>.  
 Flash-light batteries, C<sub>79</sub>.  
 Flashover voltage of electrical insulating materials, T<sub>216</sub>.  
     radio-frequency, measurement, S<sub>471</sub>.  
 Flat slab, strain gauge test, T<sub>236</sub>.  
 Flat spiral coils, inductance, S<sub>455</sub>.  
 Floor slab, test of tile and concrete, T<sub>220</sub>.  
 Flux of light, measurement, S<sub>447</sub>.  
 Focus, depth of, T<sub>217</sub>.  
 Food dyes, S<sub>440</sub>.  
 Force, electromotive, at low temperatures, S<sub>434</sub>.  
 Fuconic amide, preparation and properties of, S<sub>459</sub>.  
 Fucose, preparation of, S<sub>459</sub>.  
 Furniture, sizes, R<sub>2</sub>.

Gadolinium, S<sub>466</sub>.  
 Gauge blocks, testing and standardizing of, S<sub>436</sub>.  
 Gas burners, carbon monoxide, T<sub>212</sub>.  
     method of testing, T<sub>222</sub>.  
     efficiency of utilization, T<sub>222</sub>.  
 Gases in metals, nitrogen, S<sub>457</sub>.  
 Gas-filled lamp, color of light from, S<sub>443</sub>.  
 Gasoline deliveries, M<sub>51</sub>.  
     evaporation, M<sub>51</sub>.  
 Gasoline-flow meters (aircraft), T<sub>237</sub>.  
 Gasoline gauges (aircraft), T<sub>237</sub>.  
 Generation of very high-frequency currents, S<sub>469</sub>.  
 Generator for ultra radio frequency currents, S<sub>469</sub>.  
 Geometric mean distances, inductance calculations, S<sub>468</sub>.  
     inductance calculations, S<sub>455</sub>.  
 Gloss interior lithopone paint, C<sub>147</sub>.  
 Government radio publications, C<sub>122</sub>.  
     specifications, wood screws, C<sub>140</sub>.  
 Graphic comparison of screw thread pitches, M<sub>49</sub>.  
 Grating, stigmatic concave mounting, S<sub>441</sub>.  
 Ground, capacity of inductance coils to, S<sub>430</sub>.  
 Ground-speed indicators, T<sub>237</sub>.  
 Grounding, effect on capacity of inductance coils, S<sub>430</sub>.  
 Halide salts, S<sub>456</sub>.  
 Hardened carbon steels, structure of, S<sub>452</sub>.  
 Hardness, electrical insulating materials, measurement, S<sub>471</sub>.  
 Head resistance of radiators, T<sub>211</sub>.  
 Heads and eyes of industrial workers, national safety code for protection of, H<sub>2</sub>.  
 Heat dissipated by automobile tires, T<sub>213</sub>.  
     treatment, effect of, on magnetic properties of iron-carbon alloys, S<sub>463</sub>.  
     high-speed steels, T<sub>228</sub>.  
 Heaviside layer, influence on radio transmission, S<sub>476</sub>.  
 Heavy-capacity scales, testing, M<sub>51</sub>.  
 Hexagonal coils, inductance, S<sub>468</sub>.

High temperature of boiler plate, T<sub>219</sub>.  
 carbon steels, T<sub>219</sub>.  
 tensile tests of boiler plate, T<sub>219</sub>.  
 High-frequency resistance, inductance coils, S<sub>430</sub>.  
 measurement, S<sub>471</sub>.  
 High-speed steel, lathe tests, T<sub>228</sub>.  
 Hollow tile and concrete floor slab, test of, T<sub>220</sub>.  
 slab, loading test, T<sub>236</sub>.  
 walls, strength of, T<sub>238</sub>.  
 Homemade radio receiving sets, C<sub>121</sub>.  
 Honeycomb inductance coils, S<sub>455</sub>.  
 winding, S<sub>449</sub>.  
 Horizontal coils, field radiation of, S<sub>431</sub>.  
 How to build electron-tube detector, C<sub>133</sub>.  
 Humidity control tank, S<sub>471</sub>.  
 Hydrogen, decarburization of ferrochromium by, S<sub>448</sub>.  
 Hydrostatic tests of steel tanks, T<sub>243</sub>.  
 Illuminants, color grading of, S<sub>443</sub>.  
 Impact strength, electrical insulating materials, measurement, S<sub>471</sub>.  
 Inclinometers, T<sub>237</sub>.  
 Inclusions, iron in brass, T<sub>221</sub>.  
 Index, radio subjects, C<sub>138</sub>.  
 Inductance, alternating current, of solenoids, S<sub>472</sub>.  
 effect of frequency, S<sub>430</sub>.  
 effective, iron wires, S<sub>430</sub>.  
 multilayer coils, S<sub>455</sub>.  
 coils, S<sub>468</sub>.  
 distributed capacity, S<sub>430</sub>.  
 high-frequency resistance, S<sub>430</sub>.  
 natural wave length, S<sub>430</sub>.  
 of polygonal form, S<sub>468</sub>.  
 polygonal coils, S<sub>468</sub>.  
 Induction measurement in short bars, S<sub>458</sub>.  
 Inductor, variable, for radio set, C<sub>120</sub>.  
 Influence of frequency upon self-inductance of coils, S<sub>430</sub>.  
 Information, radio, C<sub>122</sub>.  
 Infra-red spectra, S<sub>466</sub>.  
 Inspector, radio, C<sub>122</sub>.  
 Insulating materials, electrical, T<sub>216</sub>.  
 properties, measurement, S<sub>471</sub>.  
 Intensity measurements, sound, S<sub>473</sub>.  
 Interference, S<sub>477</sub>.  
 Integrating sphere, photometric, S<sub>447</sub>.  
 Interfacial tension of oils, T<sub>223</sub>.  
 Interference methods for standardizing gauge blocks, S<sub>436</sub>.  
 testing gauge blocks, S<sub>436</sub>.  
 phenomena photography, S<sub>441</sub>.  
 Inverse fading, of radio signals, S<sub>476</sub>.  
 Inverse-rate method of thermal analysis, recording chronograph for, T<sub>230</sub>.  
 Iodine pentoxide apparatus for carbon monoxide, T<sub>222</sub>.  
 spectrophoto-electrical properties, S<sub>462</sub>.  
 Iron, alloys with carbon and manganese, S<sub>453</sub>.  
 determination of nitrogen in, S<sub>457</sub>.  
 car wheels, thermal stresses in, T<sub>209</sub>.  
 cast, thermal expansion of, S<sub>433</sub>.  
 electrolytic, thermal expansion of, S<sub>433</sub>.  
 in brass, T<sub>221</sub>.  
 microstructure, T<sub>221</sub>.  
 in cast red brass, T<sub>221</sub>.  
 inclusions in brass, T<sub>221</sub>.  
 Iron, carbon alloys, effect of manganese on micro-structure of, S<sub>464</sub>.  
 magnetic properties of, S<sub>463</sub>.  
 core transformer, S<sub>449</sub>.  
 Laminated phenolic insulating materials, T<sub>216</sub>.  
 Lathe tests, high-speed steels, T<sub>228</sub>.  
 Lattice-wound inductance coils, S<sub>455</sub>.  
 Laws, radio, C<sub>122</sub>.  
 Lead, S<sub>456</sub>.  
 antimony sulphide, spectrophoto-electrical sensitivity of, S<sub>462</sub>.  
 photo-electrical properties of halide salts of, S<sub>456</sub>.  
 standard for melting point, C<sub>25</sub>.  
 Leakage reactance, transformers, S<sub>445</sub>, S<sub>468</sub>.  
 Leather, C<sub>148</sub>.  
 belting, vegetable tanned, C<sub>148</sub>.  
 durability, T<sub>215</sub>.  
 measuring machines, M<sub>51</sub>.  
 sole, durability, T<sub>215</sub>.  
 wear tests for, T<sub>215</sub>.  
 Lenses, spherical aberration of thin, S<sub>461</sub>.  
 Licenses, radio, C<sub>122</sub>.  
 Light filters, T<sub>217</sub>.  
 waves in standardizing gauges, S<sub>436</sub>.  
 Limestone, for use in manufacture of sulphite pulp, C<sub>444</sub>.  
 Liquid measuring devices, M<sub>51</sub>.  
 Literature, radio, C<sub>122</sub>.  
 classification, C<sub>138</sub>.  
 Lithopone paint, specification, C<sub>147</sub>.  
 Loading coil, C<sub>137</sub>.  
 test of reinforced hollow tile slab, T<sub>236</sub>.  
 Losses, power, in automobile tires, T<sub>213</sub>.  
 Lubrication of wire rope, T<sub>229</sub>.  
 Luminous efficiency of radiant energy, S<sub>475</sub>.  
 Lyde, inductance formulas, S<sub>455</sub>.  
 Machining qualities of electrical insulating materials, T<sub>216</sub>.  
 Magnesia, T<sub>239</sub>.  
 crucibles, S<sub>453</sub>.  
 Magnesite, T<sub>239</sub>.  
 cement, C<sub>135</sub>.  
 stucco, C<sub>135</sub>.  
 Magnetic determination of iron in brass, T<sub>221</sub>.  
 measurements, S<sub>458</sub>.  
 permeability of brass containing iron, T<sub>221</sub>.  
 of short bars, apparatus for determining, S<sub>458</sub>.  
 properties of iron-carbon alloys, S<sub>463</sub>.  
 susceptibility of brass containing iron, T<sub>221</sub>.  
 Magnetite, analyzed iron ore, C<sub>25</sub>.  
 Manganese, analyzed ore, C<sub>25</sub>.  
 dioxide, C<sub>79</sub>.  
 effect upon structure of carbon steels, S<sub>464</sub>.  
 effects on mechanical properties of pure iron, S<sub>453</sub>.  
 Martens, inductance formulas, S<sub>468</sub>.  
 Martensite in carbon steels, S<sub>452</sub>.  
 Materials, insulating, electrical, T<sub>216</sub>.  
 photographic, sensitivity to charred paper emanations, S<sub>454</sub>.  
 Mattresses, sizes, R<sub>2</sub>.  
 Measuring, plasticity of clays, T<sub>234</sub>.  
 Measurement, magnetic properties of short bars, S<sub>458</sub>.

Measurement of high pressures, piezo-electric method for, S<sub>445</sub>.  
 properties of electrical insulating materials, T<sub>216</sub>.  
 properties of electrical insulating materials, S<sub>471</sub>.  
 wave lengths, in neodymium spectra, S<sub>442</sub>.  
 energy distribution in star spectra, S<sub>438</sub>.  
 wave length, samarium spectra, S<sub>442</sub>.

Mechanical properties of electrical insulating materials, T<sub>216</sub>.  
 measurement, S<sub>471</sub>.  
 pure iron and alloys with carbon and manganese, S<sub>453</sub>.

Melting points, standard samples, C<sub>25</sub>.  
 Mercurial barometers, testing of, C<sub>46</sub>.  
 Mercury barometers, testing of, C<sub>46</sub>.  
 Meteorological conditions, effect on radio transmission, S<sub>476</sub>.

Metallographic etching reagents, S<sub>435</sub>.  
 Metals, standard temperature samples, C<sub>25</sub>.  
 Method for preparing raffinose, S<sub>432</sub>.  
 interference, for standardizing gauge blocks, S<sub>436</sub>.  
 for testing gauge blocks, S<sub>436</sub>.  
 of expressing weight of duck by square yard basis, C<sub>136</sub>.  
 of testing oils, T<sub>223</sub>.

Methyl tetronic acid lactone from fucose, properties of, S<sub>459</sub>.  
 amide from fucose, properties of, S<sub>459</sub>.

Metric screw threads, M<sub>49</sub>.

Micrometers, T<sub>226</sub>.

Microstructure of brass containing iron, T<sub>221</sub>.

Mill white, gloss paint, C<sub>147</sub>.

Milk bottle, requirements, M<sub>51</sub>.

Minimum requirements for small dwellings, Special Pub.

Modulus of elasticity of wire rope, T<sub>229</sub>.

Moisture absorption, electrical insulating materials, measurement, S<sub>471</sub>.  
 content (press cloth), T<sub>231</sub>.

Molasses, recovery of by-products from, C<sub>445</sub>.

Mollier, chart of properties of ammonia, M<sub>52</sub>.

Molybdenite, artificial preparation, S<sub>462</sub>.  
 chemical analysis, S<sub>462</sub>.  
 photo-electrical properties, S<sub>462</sub>.  
 photopositive and photonegative properties, S<sub>398</sub>, S<sub>462</sub>.  
 polarization, S<sub>338</sub>.  
 spectral reflection, S<sub>338</sub>.  
 transmission, S<sub>338</sub>.

Molybdenum, photo-electrical properties of oxide and sulphides of, S<sub>322</sub>, S<sub>338</sub>, S<sub>398</sub>, S<sub>462</sub>.  
 series in the arc spectrum of, S<sub>474</sub>.

Moments and stresses in floor slab, T<sub>220</sub>.

Multilayer coils, inductance, S<sub>455</sub>.  
 polygonal, inductance, S<sub>468</sub>.

Mutual inductance, multilayer coils, S<sub>455</sub>.  
 polygons, S<sub>468</sub>.

Nagaoka, inductance formula, S<sub>455</sub>.

Naphthalene, standard for calorimetry, C<sub>25</sub>.

National safety code for protection of heads and eyes of industrial workers, H<sub>2</sub>.

Natural-gas burners, carbon monoxide, T<sub>212</sub>.  
 wave length of inductance coils, S<sub>430</sub>.

Navigation instruments (aircraft), T<sub>237</sub>.

Negative photo-electrical properties, S<sub>398</sub>, S<sub>462</sub>.  
 Neodymium arc spectra wave-length measurements, S<sub>442</sub>.

Nickel, etching reagents, S<sub>435</sub>.  
 steel standards for analysis, C<sub>25</sub>.

Nitrogen in iron and steel, S<sub>457</sub>.

Nocturnal variation, of radio signals, S<sub>476</sub>.

Numbered cotton duck, specification, C<sub>136</sub>.

Objectives for photographic use, T<sub>217</sub>.  
 visual use, T<sub>217</sub>.

Octagonal coils, inductance, S<sub>468</sub>.

Oil content (press cloth), T<sub>231</sub>.  
 pressing, T<sub>231</sub>.

Oils, interfacial tension of, T<sub>223</sub>.  
 methods of testing, T<sub>223</sub>.  
 organic acidity of, T<sub>223</sub>.  
 reclaimed, T<sub>223</sub>.  
 refining, T<sub>223</sub>.  
 tension, interfacial, T<sub>223</sub>.  
 test methods, T<sub>223</sub>.

Operation of simple radio receiving outfit, C<sub>120</sub>.

Operator license, radio, C<sub>122</sub>.

Organic acidity of oils, T<sub>223</sub>.

Oxalate, sodium, standard, C<sub>25</sub>.

Oxidimetry, sodium oxalate as standard, C<sub>25</sub>.

Oxygen instruments (aircraft), T<sub>237</sub>.

Paint for integrating photometric sphere, S<sub>447</sub>.  
 materials, turpentine specification, C<sub>86</sub>.  
 gloss interior lithopone, C<sub>147</sub>.

Pancake coils, inductance, S<sub>455</sub>.

Paper making, specification for quicklime for use in causticizing, C<sub>143</sub>.  
 micrometers, T<sub>226</sub>.  
 pulp, limestone and quicklime for use in manufacture of sulphite pulp, C<sub>144</sub>.

Parabolic reflector for directive transmission, S<sub>469</sub>.

Parallelism of gauge blocks, S<sub>436</sub>.

Patent survey, treatment of beet-sugar waste water, C<sub>145</sub>.

Paving bricks, R<sub>1</sub>.

Performance, modern high-speed steels, T<sub>228</sub>.

Periodicals, radio, C<sub>122</sub>.

Permanent records, photomicrographs, T<sub>217</sub>.

Permanganate solution, standardization, C<sub>25</sub>.

Permeability, magnetic, of brass containing iron, T<sub>221</sub>.

Phase difference, insulating materials, measurement, S<sub>471</sub>.  
 of electrical insulating materials, T<sub>216</sub>.

Phenolic insulating materials, T<sub>216</sub>.

Photo-electrical investigations, S<sub>319</sub>, S<sub>322</sub>, S<sub>338</sub>, S<sub>344</sub>, S<sub>388</sub>, S<sub>398</sub>, S<sub>446</sub>, S<sub>451</sub>, S<sub>456</sub>, S<sub>462</sub>.  
 properties, negative and positive, S<sub>398</sub>, S<sub>462</sub>.  
 sensitivity, S<sub>446</sub>, S<sub>451</sub>, S<sub>456</sub>.  
 tests, argentite, S<sub>398</sub>, S<sub>446</sub>.  
 barium (Case's cell), S<sub>462</sub>.  
 bismuthinite, S<sub>322</sub>, S<sub>344</sub>.  
 boulangerite, S<sub>322</sub>, S<sub>446</sub>.  
 bournonite, S<sub>451</sub>.  
 cuprous oxide, S<sub>462</sub>.  
 cylindrite, S<sub>322</sub>, S<sub>344</sub>.  
 galena, S<sub>344</sub>.  
 gallium, S<sub>322</sub>.  
 iodine, S<sub>462</sub>.  
 jamecosite, S<sub>322</sub>, S<sub>344</sub>, S<sub>462</sub>.  
 lead, halide salts of, S<sub>456</sub>.

Photo-electrical sensitivity tests, lead antimony sulphide, S<sub>462</sub>.  
 miscellaneous preparations, S<sub>462</sub>.  
 molybdenite, S<sub>322</sub>, S<sub>338</sub>, S<sub>398</sub>, S<sub>462</sub>.  
 potassium hydride, S<sub>319</sub>.  
 proustite, S<sub>412</sub>.  
 pyrargyrite, S<sub>451</sub>.  
 pyrites, S<sub>322</sub>, S<sub>344</sub>.  
 selenium, S<sub>319</sub>, S<sub>322</sub>, S<sub>338</sub>.  
 silver, halide salts of, S<sub>456</sub>.  
 silver nitrate, S<sub>462</sub>.  
 silver sulphide, S<sub>344</sub>, S<sub>398</sub>, S<sub>446</sub>.  
 stibnite, S<sub>322</sub>, S<sub>398</sub>, S<sub>446</sub>.  
 strontium (Case's cell), S<sub>462</sub>.  
 tellurium, S<sub>322</sub>.  
 thallium, halide salts of, S<sub>456</sub>.  
 thalofide (Case's cell), S<sub>380</sub>.  
 various substances, S<sub>322</sub>, S<sub>344</sub>, S<sub>398</sub>, S<sub>462</sub>.

Photographic action of charred paper, S<sub>454</sub>.  
 emulsions, sensitometry of, S<sub>439</sub>.  
 filter factors, S<sub>439</sub>.  
 materials, sensitivity to charred paper emanations, S<sub>454</sub>.  
 use of objectives, T<sub>217</sub>.  
 Photography of interference phenomena, S<sub>441</sub>.  
 Photometry, integrating sphere, S<sub>447</sub>.  
 Photomicrographs as permanent records, T<sub>217</sub>.  
 Photomicrography, T<sub>217</sub>.  
 of stained fibers, T<sub>217</sub>.  
 Piezo-electric method for measuring high pressures, S<sub>445</sub>.  
 Pitches, screw thread, graphic comparison of, M<sub>49</sub>.  
 Planeness of gauges, S<sub>436</sub>.  
 Planetary radiation, S<sub>244</sub>, S<sub>460</sub>.  
 Plastic flow, T<sub>234</sub>.  
 Plasticity, methods of measuring, T<sub>234</sub>.  
 Plates, photographic, American, characteristics of, S<sub>439</sub>.  
 Polygonal coils, inductance, S<sub>468</sub>.  
 Pottery materials, ball clays, T<sub>227</sub>.  
 Power-loss, T<sub>240</sub>.  
 electrical insulating materials, measurement, S<sub>471</sub>.  
 Power losses in automobile tires, T<sub>213</sub>.  
 Precision standard manufacture, M<sub>51</sub>.  
 Preparation of spectrum tubes, S<sub>441</sub>.  
 raffinose, S<sub>432</sub>.  
 Press cloth, T<sub>231</sub>.  
 Pressure gauges (aircraft), T<sub>237</sub>.  
 tests of steel tanks, T<sub>243</sub>.  
 Pressures, instantaneous measurement of, S<sub>445</sub>.  
 Progressive fading, of radio signals, S<sub>476</sub>.  
 Properties, ammonia, Mollier chart, M<sub>52</sub>.  
 tables and Mollier chart, C<sub>142</sub>.  
 high-speed steels, T<sub>228</sub>.  
 mechanical, pure iron and alloys, S<sub>453</sub>.  
 of ball clays, T<sub>227</sub>.  
 of steels and irons, S<sub>433</sub>.  
 spectral transmissive, of dyes, S<sub>440</sub>.  
 tensile, boiler plate at high temperatures, T<sub>219</sub>.  
 Publications, radio, C<sub>122</sub>.  
 Pure iron alloys, S<sub>453</sub>.  
 Purification, composition and certain constants of ammonia, S<sub>465</sub>.  
 Pyrargyrite, S<sub>451</sub>.  
 Pyrometers, metals for standardizing, C<sub>25</sub>.

Quartz rock salt spectrograph, S<sub>441</sub>.  
 Quicklime, for use in causticizing, C<sub>143</sub>.  
 for use in manufacture of sulphite pulp, C<sub>144</sub>.

Radiant energy, visibility of, S<sub>475</sub>.  
 Radiation from horizontal coil antennas, S<sub>431</sub>.  
 of stars, S<sub>438</sub>.  
 stellar and planetary, S<sub>244</sub>, S<sub>438</sub>, S<sub>460</sub>.  
 Radiator core, investigations, T<sub>211</sub>.  
 Radiators for aircraft engines, T<sub>211</sub>.  
 Radio, S<sub>477</sub>.  
 classification, C<sub>138</sub>.  
 electron-tube detector for, C<sub>133</sub>.  
 fading, S<sub>476</sub>.  
 frequency amplification, S<sub>449</sub>, S<sub>450</sub>.  
 properties, insulating materials, measurement, S<sub>471</sub>.  
 inductance of coils used in, S<sub>468</sub>.  
 information, sources, C<sub>122</sub>.  
 publications, C<sub>122</sub>.  
 receiving outfit, simple, construction of, C<sub>120</sub>.  
 condensers and loading coil for, C<sub>137</sub>.  
 set, amplifier, C<sub>141</sub>.  
 sets, C<sub>121</sub>.  
 regulations, C<sub>122</sub>.  
 Service Bulletin, C<sub>122</sub>.  
 Radiometers, stellar, S<sub>188</sub>, S<sub>229</sub>, S<sub>244</sub>, S<sub>438</sub>, S<sub>460</sub>.  
 Radiometry, stellar, S<sub>438</sub>.  
 Radius, equivalent, polygonal coils, S<sub>468</sub>.  
 Raffinose, preparation of, S<sub>432</sub>.  
 Rail steel, titanium and silicon deoxidation of, T<sub>241</sub>.  
 Rare earths, S<sub>466</sub>.  
 Rate-of-climb indicators, T<sub>237</sub>.  
 Rate of exhaustion by reciprocating air pump, T<sub>224</sub>.  
 Rate of sulphation, T<sub>225</sub>.  
 Reactance, leakage, transformers, S<sub>455</sub>.  
 Reagents, metallographic etching, S<sub>435</sub>.  
 Receiving set, amplifier for, C<sub>141</sub>.  
 condensers and loading coil for, C<sub>137</sub>.  
 sets, radio, C<sub>121</sub>.  
 Reciprocating air pump, rate of exhaustion by, T<sub>224</sub>.  
 Reclaimed oils, T<sub>223</sub>.  
 Recommended minimum requirements for small-dwelling construction, Special Pub.  
 Recording instruments (aircraft), T<sub>237</sub>.  
 Records, permanent, photomicrographs, T<sub>217</sub>.  
 Red, enamel, C<sub>146</sub>.  
 United States specification for, C<sub>146</sub>.  
 Redwood viscometer, T<sub>210</sub>.  
 Refining oils, T<sub>223</sub>.  
 Reflection of radio waves, S<sub>476</sub>.  
 of very short electric waves, S<sub>469</sub>.  
 white surfaces, S<sub>447</sub>.  
 Refraction, of radio waves, S<sub>476</sub>.  
 Regulations, radio, C<sub>122</sub>.  
 Reinforced concrete building test, T<sub>236</sub>.  
 test of, T<sub>220</sub>.  
 Requirements, minimum, for small-dwelling construction, Special Pub.  
 Resistance, alternating current, of solenoids, S<sub>472</sub>.  
 coupling, S<sub>449</sub>.  
 effective, skin effect, S<sub>430</sub>.  
 high-frequency, inductance coils, S<sub>430</sub>.  
 inductance coils, S<sub>430</sub>.  
 radio-frequency, measurement, S<sub>471</sub>.

Resistance, radio-frequency, polygonal coils, S<sub>468</sub>.  
 variation method, radio measurements, S<sub>471</sub>.  
 Resistivity of electrical insulating materials, T<sub>216</sub>.  
 insulating materials, measurement, S<sub>471</sub>.  
 Riveted tanks, stresses in, T<sub>243</sub>.  
 Rock salt, quartz, spectrograph, S<sub>441</sub>.  
 Rotation of fucose, S<sub>459</sub>.  
 Rotary dispersion method for measurement of color temperature, S<sub>443</sub>.  
 Round wire, polygons, inductance, S<sub>468</sub>.

Saccharimetry, standard sample of sucrose, C<sub>25</sub>.  
 Safety code, national, for protection of heads and eyes of industrial workers, H<sub>2</sub>.  
 Samarium arc spectra wave lengths, S<sub>442</sub>.  
 Screen, shielding, radio measurements, S<sub>471</sub>.  
 Screw-thread pitches, graphic comparison of, M<sub>49</sub>.  
 Screws, wood, Government specification, C<sub>40</sub>.  
 Seasonal variation, of radio signals, S<sub>476</sub>.  
 Selenium, photo-electrical properties, S<sub>319</sub>, S<sub>322</sub>, S<sub>338</sub>.  
 Self-inductance, formulas and tables for, S<sub>468</sub>.  
 polygonal coils, S<sub>468</sub>.  
 Sensibility of eye, S<sub>475</sub>.  
 Sensitivity of photographic materials to charred paper emanations, S<sub>454</sub>.  
 photo-electrical, S<sub>446</sub>, S<sub>451</sub>, S<sub>456</sub>.  
 spectrophot-electrical, S<sub>446</sub>.  
 Sensitometry of photographic emulsions, S<sub>439</sub>.  
 Serialization law in Pennsylvania, M<sub>51</sub>.  
 Series in molybdenum, S<sub>474</sub>.  
 Sheaves, effect on wire rope, T<sub>229</sub>.  
 Shellac, source and manufacture, T<sub>232</sub>.  
 specifications, T<sub>232</sub>.  
 testing, T<sub>232</sub>.  
 Shielding, radio-measuring circuits, S<sub>471</sub>.  
 Short bars, apparatus for determining magnetic properties of, S<sub>458</sub>.  
 Short-time intervals, S<sub>470</sub>.  
 Short wave directive transmission, S<sub>469</sub>.  
 Short waves, susceptibility of fading, S<sub>476</sub>.  
 Sieves, standard cement for testing, C<sub>25</sub>.  
 Signal, radio, effect of fading, S<sub>476</sub>.  
 strength, variation of, S<sub>476</sub>.  
 Silicon, as a deoxidizer of rail steel, T<sub>241</sub>.  
 Silver, S<sub>456</sub>.  
 photo-electrical properties of halide salts of, S<sub>456</sub>.  
 sulphide of, S<sub>344</sub>, S<sub>398</sub>, S<sub>446</sub>.  
 Simple electron-tube detector, C<sub>133</sub>.  
 radio receiving outfit, C<sub>120</sub>.  
 sets, C<sub>121</sub>.  
 Simplification of sizes of bedsteads, R<sub>2</sub>.  
 brick, paving, R<sub>1</sub>.  
 commercial practice, R<sub>1</sub>, R<sub>2</sub>.  
 mattresses, R<sub>2</sub>.  
 paving brick, R<sub>1</sub>.  
 springs, bedstead, R<sub>2</sub>.  
 Single-layer polygonal coils, S<sub>468</sub>.  
 Sizes of paving bricks, bedsteads, mattresses, springs, etc., R<sub>1</sub>, R<sub>2</sub>.  
 Skin effect, electrical resistance, S<sub>430</sub>.  
 inductance coils, S<sub>430</sub>.  
 Slab beams reinforced diagonally, T<sub>233</sub>.  
 hollow tile and reinforced concrete, test, T<sub>236</sub>.  
 test of tile and concrete floor, T<sub>220</sub>.

Soap, automobile, laboratory examination, C<sub>127</sub>.  
 sampling, C<sub>127</sub>.  
 specification, C<sub>127</sub>.  
 chip, laboratory examination, C<sub>128</sub>.  
 sampling, C<sub>128</sub>.  
 specification, C<sub>128</sub>.  
 discussion of specifications for, C<sub>62</sub>.  
 general composition and varieties, C<sub>62</sub>.  
 grit cake, laboratory examination, C<sub>130</sub>.  
 sampling, C<sub>130</sub>.  
 specification, C<sub>130</sub>.  
 hand grit, laboratory examination, C<sub>132</sub>.  
 sampling, C<sub>132</sub>.  
 specification, C<sub>132</sub>.  
 liquid, laboratory examination, C<sub>124</sub>.  
 sampling, C<sub>124</sub>.  
 specification, C<sub>124</sub>.  
 ordinary laundry, laboratory examination, C<sub>129</sub>.  
 sampling, C<sub>129</sub>.  
 specification, C<sub>129</sub>.  
 powder, laboratory examination, C<sub>125</sub>.  
 sampling, C<sub>125</sub>.  
 specification, C<sub>125</sub>.  
 salt water, laboratory examination, C<sub>126</sub>.  
 sampling, C<sub>126</sub>.  
 specification, C<sub>126</sub>.  
 scouring compounds, laboratory examination, C<sub>131</sub>.  
 sampling, C<sub>131</sub>.  
 specification, C<sub>131</sub>.  
 white floating, laboratory examination, C<sub>123</sub>.  
 sampling, C<sub>123</sub>.  
 specification, C<sub>123</sub>.  
 Sole leather, durability, T<sub>215</sub>.  
 Solenoids, alternating-current, resistance and inductance of, S<sub>472</sub>.  
 Solenoids, circular, inductance, S<sub>468</sub>.  
 inductance, S<sub>455</sub>.  
 square, inductance, S<sub>468</sub>.  
 Solubility of dextrose in water, S<sub>437</sub>.  
 Sound-intensity measurements, S<sub>473</sub>.  
 Spaced windings, inductance coils, S<sub>455</sub>.  
 Specific rotation of fucose, S<sub>459</sub>.  
 volume saturated ammonia vapor, S<sub>467</sub>.  
 Specification, automatic scales, M<sub>51</sub>.  
 automobile soap, C<sub>127</sub>.  
 chip soap, C<sub>128</sub>.  
 dry cells, C<sub>79</sub>, C<sub>139</sub>.  
 enamel, red, C<sub>146</sub>.  
 fire-extinguishing liquid, C<sub>134</sub>.  
 gloss interior lithopone paint, C<sub>147</sub>.  
 grit cake soap, C<sub>130</sub>.  
 hand grit soap, C<sub>132</sub>.  
 hard water laundry soap, C<sub>62</sub>.  
 limestone and quicklime for use in manufacture of sulphite pulp, C<sub>44</sub>.  
 liquid soap, C<sub>124</sub>.  
 milled toilet soap, C<sub>62</sub>.  
 ordinary laundry soap, C<sub>129</sub>.  
 paint, C<sub>69</sub>.  
 materials, see each special subject.  
 quicklime for use in causticizing, C<sub>143</sub>.  
 salt water soap, C<sub>126</sub>.  
 scouring compounds, C<sub>131</sub>.  
 soap powder, C<sub>125</sub>.  
 special grade laundry soap, C<sub>62</sub>.  
 turpentine, C<sub>86</sub>.

Specification, United States for red enamel, C<sub>146</sub>.  
     white floating soap, C<sub>123</sub>.  
     wood screws, C<sub>40</sub>.

Specimens, electrical insulating materials, preparation, S<sub>471</sub>.

Spectra, star, measurements of energy distribution, S<sub>438</sub>.

Spectral center of gravity, S<sub>443</sub>.  
     energy distribution of a star, S<sub>438</sub>.  
     transmittancy of dyes, S<sub>440</sub>.

Spectrograph, quartz rock salt, S<sub>441</sub>.

Spectrographic analysis, S<sub>444</sub>.

Spectrophoto-electrical sensitivity, S<sub>446</sub>, S<sub>451</sub>, S<sub>456</sub>.

Spectrophotometry, S<sub>440</sub>.

Spectroscopic notes, S<sub>441</sub>.

Spectrum analysis, S<sub>477</sub>.

Spectrum tubes, preparation of, S<sub>441</sub>.  
     visibility of radiant energy in, S<sub>475</sub>.

Speed of photographic plates, S<sub>439</sub>.

Sphere, integrating photometric, S<sub>447</sub>.

Spherical aberration of thin lenses, S<sub>461</sub>.  
     candlepower, measurement by sphere, S<sub>441</sub>.

Spirals, inductance, S<sub>455</sub>.

Springs, bedstead, sizes, R<sub>2</sub>.

Square coils, inductance, S<sub>468</sub>.

Staining of fibers for photomicrography, T<sub>217</sub>.

Standard samples, C<sub>25</sub>.  
     alloy steels, C<sub>25</sub>.  
     bearing metals, C<sub>25</sub>.  
     benzoic acid, C<sub>25</sub>.  
     brass, C<sub>25</sub>.  
     bronze, C<sub>25</sub>.  
     cement, C<sub>25</sub>.  
     iron, C<sub>25</sub>.  
         ores, C<sub>25</sub>.  
     limestone, C<sub>25</sub>.  
     magnetite ore, C<sub>25</sub>.  
     manganese ore, C<sub>25</sub>.  
     naphthalene, C<sub>25</sub>.  
     sodium oxalate, C<sub>25</sub>.  
     steel, C<sub>25</sub>.  
     sugars, C<sub>25</sub>.  
     thermomeric fixed points, C<sub>25</sub>.  
     zinc ore, C<sub>25</sub>.  
     sodium oxalate, C<sub>25</sub>.  
     turpentine specification, C<sub>36</sub>.  
     wave lengths, S<sub>441</sub>.

Standardization, *see* Simplification and Specification.

of paving brick sizes, R<sub>1</sub>.  
     bomb calorimeters, C<sub>25</sub>.  
     cement sieves, C<sub>25</sub>.

Standardizing gauges, S<sub>436</sub>.

Standards, Bureau, *see* Annual report.

Stars, spectral energy distribution, S<sub>438</sub>.

Station call letters, radio, C<sub>122</sub>.  
     license, radio, C<sub>122</sub>.

Statoscopes, T<sub>237</sub>.

Steel car wheels, thermal stresses in, T<sub>235</sub>.  
     carbon, at high temperatures, T<sub>219</sub>.  
     determination of nitrogen in, S<sub>457</sub>.  
     standard samples, C<sub>25</sub>.  
     as affected by manganese, S<sub>464</sub>.  
     hardened and of tempered, S<sub>452</sub>.  
     tanks, stresses in, T<sub>243</sub>.  
     thermal expansion of, S<sub>433</sub>.  
     titanium and silicon deoxidation of, T<sub>241</sub>.

Steel car wheels, tensile tests at high temperatures, T<sub>219</sub>.

Stellar radiometry, S<sub>438</sub>.  
     temperatures, S<sub>438</sub>, S<sub>460</sub>.

Stibnite, spectrophoto-electrical properties, S<sub>322</sub>, S<sub>398</sub>, S<sub>462</sub>.

Storage batteries, S<sub>450</sub>, T<sub>225</sub>.

Strain gauge measurements on steel tanks, T<sub>243</sub>.  
     test of reinforced concrete flat slab, T<sub>236</sub>.

Strays, relation to radio reception, S<sub>476</sub>.

Strength of electrical insulating materials, T<sub>216</sub>.  
     hollow tile walls, T<sub>238</sub>.

Stresses in slabs reinforced diagonally, T<sub>233</sub>.

steel tanks, T<sub>243</sub>.  
     thermal, in car wheels, T<sub>209</sub>.  
     in steel car wheels, T<sub>235</sub>.

Strontrium, Case's photo-electric cells, S<sub>462</sub>.

Strut thermometers (aircraft), T<sub>237</sub>.

Struts, T<sub>218</sub>.

Subject classification, radio, C<sub>138</sub>.

Substitution weighing, T<sub>208</sub>.

Sucrose, standard sample, C<sub>25</sub>.

Sulphation of storage battery plates, T<sub>225</sub>.

Sulphide, silver, S<sub>46</sub>.

Sulphite pulp, limestone and quicklime for use in manufacture of, C<sub>144</sub>.  
     cellulose extract, T<sub>215</sub>.

Sunrise and sunset, effect on radio transmission, S<sub>476</sub>.

Susceptibility, magnetic, of brass containing iron, T<sub>221</sub>.

Systems of screw threads, M<sub>49</sub>.

Swinging, effect of reception of signals, S<sub>476</sub>.

Tables, thermodynamic properties of ammonia, C<sub>142</sub>.

Tachometers (aircraft), T<sub>237</sub>.

Tanks, stresses in steel, T<sub>243</sub>.

Telephone-shunt condenser, C<sub>137</sub>.

Telescopic objective, graphical solution for a, S<sub>461</sub>.

Temperature effect on tensile properties of boiler plate, T<sub>219</sub>.  
     of stars, S<sub>438</sub>.

Temperatures, planetary, S<sub>460</sub>.  
     stellar, S<sub>438</sub>, S<sub>460</sub>.

Tempering of steel, structural changes accompanying, S<sub>452</sub>.

Tensile strength, electrical insulating materials, measurement, S<sub>471</sub>.

Tensile tests, boiler plate, at high temperatures, T<sub>219</sub>.  
     apparatus for, T<sub>219</sub>.

Tension, interfacial, of oils, T<sub>223</sub>.

Terrestrial magnetism, relation to radio signals, S<sub>476</sub>.

Test methods for duck, C<sub>136</sub>.  
     of hollow tile and concrete floor slab, T<sub>220</sub>.

Testing ball clays, T<sub>227</sub>.  
     electrical insulating materials, S<sub>471</sub>.  
     of dry cells, C<sub>79</sub>.  
     pyrometer, C<sub>25</sub>.

Tests, compressions, T<sub>218</sub>.  
     of stellar radiometers, S<sub>438</sub>.  
     of welded and riveted tanks, T<sub>243</sub>.

Textbooks, radio, C<sub>122</sub>.

Thallium, S<sub>456</sub>.  
     photo-electrical properties of halide salts of, S<sub>456</sub>.

Thermal analysis, recording chronograph for inverse-rate method of, T<sub>230</sub>.  
 expansion, electrical insulating materials, measurement, S<sub>471</sub>.  
 of steels, S<sub>433</sub>.  
 expansivity of electrical insulating materials, T<sub>216</sub>.  
 stresses in chilled iron car wheels, T<sub>209</sub>.  
 in steel car wheels, T<sub>235</sub>.  
 Thermocouples, sensitivity tests of stellar, S<sub>188</sub>, S<sub>229</sub>, S<sub>244</sub>, S<sub>438</sub>, S<sub>460</sub>.  
 Thermodynamic properties of ammonia, tables and Mollier chart of, C<sub>142</sub>.  
 Thermometers (aircraft), T<sub>237</sub>.  
 Thermometric fixed points, C<sub>25</sub>.  
 Thickness, T<sub>226</sub>.  
 of paper, T<sub>226</sub>.  
 Thin lenses, spherical aberration of, S<sub>461</sub>.  
 Tile and concrete floor slab test, T<sub>220</sub>.  
 slab, loading test, T<sub>236</sub>.  
 walls, strength of, T<sub>238</sub>.  
 Time, effect on strains in concrete, T<sub>236</sub>.  
 measurement of short-time intervals, S<sub>470</sub>.  
 Tin, standard for melting point, C<sub>25</sub>.  
 Tire, automobile, losses in, T<sub>213</sub>.  
 Tires, T<sub>240</sub>.  
 Titanium, as a deoxidizer of rail steel, T<sub>241</sub>.  
 Ton of coal, proposed weight, M<sub>51</sub>.  
 Transformer, amplifier, C<sub>141</sub>.  
 coupling, S<sub>449</sub>.  
 Transformers, leakage reactance, S<sub>455</sub>, S<sub>468</sub>.  
 Transmissive, spectral, properties of dyes, S<sub>440</sub>.  
 Transmittancy, spectral, of dyes, S<sub>440</sub>.  
 Triangular coils, inductance, S<sub>468</sub>.  
 Tubes, spectrum, S<sub>441</sub>.  
 Tuned-plate coupling, S<sub>449</sub>.  
 Tungar rectifier tube, S<sub>450</sub>.  
 Turn indicators, T<sub>237</sub>.  
 Turpentine specification, C<sub>86</sub>.

Ulbricht integrating sphere, theory and construction, S<sub>447</sub>.  
 Ultra radio frequency directive transmission, S<sub>469</sub>.  
 Unit type radio receiving set, C<sub>133</sub>.  
 Universal-wound inductance coils, S<sub>455</sub>.  
 Utilization of beet sugar waste water, C<sub>145</sub>.  
 Vacuum fused alloys of iron, S<sub>453</sub>.  
 Vanadium, analyzed steels, C<sub>25</sub>.  
 Vapor, specific volume of saturated ammonia, S<sub>467</sub>.  
 Varnish, shellac, T<sub>232</sub>.  
 Vegetation, effect on signal intensity, S<sub>476</sub>.  
 Viscometer, Redwood, T<sub>210</sub>.  
 Viscosimeter, conversion tables, T<sub>210</sub>.  
 Visibility of radiant energy, S<sub>475</sub>.  
 Visual use of objectives, T<sub>217</sub>.  
 Volume resistivity, measurement, S<sub>471</sub>.  
 specific, of saturated ammonia vapor, S<sub>467</sub>.  
 Walls, hollow tile, strength of, T<sub>238</sub>.  
 Waste elimination, R<sub>1</sub>, R<sub>2</sub>, and Spec. Pub.  
 Water soluble (press cloth), T<sub>231</sub>.  
 solubility of dextrose in, S<sub>437</sub>.  
 vapor detector, T<sub>242</sub>.  
 Wave-length measurements in neodymium arc spectra, S<sub>442</sub>.  
 in samarium arc spectra, S<sub>442</sub>.  
 relation to fading, S<sub>476</sub>.  
 standard, in cadmium spectrum, S<sub>441</sub>.  
 Wave lengths, S<sub>466</sub>.  
 Wave, transmission phenomena, S<sub>476</sub>.  
 Wear tests for leather, T<sub>215</sub>.  
 Weather, effect on radio transmission, S<sub>476</sub>.  
 Weighing, by substitution, T<sub>208</sub>.  
 Weights and measures, fifteenth conference, M<sub>51</sub>.  
 Welded tanks, stresses in, T<sub>243</sub>.  
 Wire rope on sheaves, T<sub>229</sub>.  
 Wires, properties at high frequencies, S<sub>430</sub>.  
 Wood screws, Government specification, C<sub>140</sub>.  
 Workability of clay, *see* Plasticity, T<sub>234</sub>.  
 Zinc, standard for melting point, C<sub>25</sub>.





